The VA BIM Guide

Department of Veterans Affairs

VA BIM GUIDE v1.0 APRIL 2010

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The VA BIM Guide

1. VA's Building Information Lifecycle Vision

Mission Statement:

> *"**The U.S. Department of Veterans Affairs (VA) Office of Construction & Facilities Management (CFM) provides design, major construction, and lease project management, design and construction standards, environmental, and historic preservation services and expertise to the Department of Veterans Affairs to deliver high quality, cost effective facilities in support of our Nation's Veterans.***

VA's Office of Construction and Facilities Management (CFM) has determined that Building Information Modeling (BIM) represents both an enhanced technology and a process change for the architecture-engineering-construction-facilities management industry. VA is committed to moving both the organization and its service providers to BIM as effectively and efficiently as possible, and to integrating BIM process requirements and Integrated Project Delivery (IPD) methodologies into its delivery requirements.

The goal of CFM's conversion to BIM is to deliver higher value and maximize lifecycle building performance to support VA's mission to deliver excellent medical services. Just as the VA's digitization of patient records has greatly improved the business and management process of care delivery for patients, so the digitization of building data will improve the design and management of VA buildings across their lifecycles—from concept to design to construction to operations to reuse and eventual demolition. And, just as standardized data in electronic medical records helps VA find ways to improve patient care, so standardized building data available electronically across VA will help the agency find better ways to design and manage its facilities in the future.

To achieve this vision, VA issued instructions that Industry Foundation Classes (IFC)-compliant BIM authoring tools be used as the architectural/engineering software for all major construction and renovation projects (capital projects appropriated at over $10M) starting design in FY 2009. This guidance shall apply to design and construction by the architects, engineers, other consultants, and contractors hired for those projects by VA. VA's Minor Program shall actively support and encourage the use of BIM where practicable, taking into account the size, type of project, and the availability of the BIM skill sets that are needed to accomplish the project.

2. Implementation

2.1 Acquisition Strategy

The project acquisition strategy will define the BIM model creation, and hence it is imperative that the decision to use Design-Bid-Build (DBB), Design Build (DB), or Integrated Design & Construction (IDC)[1] etc., be determined at the initial stage of the project so that BIM can be properly structured and managed to support the acquisition. The contracts will define the integration or separation of risk and responsibilities for the design and construction contracting entities, and therefore, the Level of Development (LoD) and division of responsibilities, such as the number of BIM Managers (there may be only one BIM Manager throughout the project if IDC or DB is used, and two, a Design and a Construction BIM Manager if DBB is used). Similarly, contractually defined risk will also determine

[1] VA uses the acronym of Integrated Design & Construction (IDC) instead of the more commonly used Integrated Design Process (IDP)

whether there are separate design intent and construction BIM models, or whether they can be combined into one model.

VA is committed to the interoperability of data as a strategic management issue to insure VA's access to building information over the life of the capital asset. Therefore, any software that meets VA interoperability standards is acceptable for use on VA projects, with VA approval. It is also critical that national standards and protocols are used in developing the models, such OmniClass, Uniformat, Masterformat[2], VA National Standards, National BIM Standards (NBIMS), etc., so that information can be machine read and normalized for VA management purposes. Unique GUIDs,[3] assigned in the BIM tools, shall be maintained to support data in workflows.

2.2 BIM Responsibilities

BIM authoring tools, data integration, and collaborative team workflow environments shall be used to develop and produce project information and documentation as required for submittals in *Program Guide PG 18-15: A/E Submission Instructions for Major New Facilities, Additions & Renovations.* BIM use shall be maximized for project reviews, decision support, design analysis, and quality assurance during all phases of the project.

It is the responsibility of all consultants and contractors to have or obtain, at their cost, the trained personnel, hardware, and software needed to successfully use BIM for the project. Equipment used by the subcontractors during the on-site coordination meetings must meet the requirements of the software being implemented so as not to cause delays in modeling and redrawing. All technical disciplines shall be responsible for their data integration and data reliability of their work and coordinated BIMs.

2.3 Data Reuse

It is important to VA to own, reuse, and properly manage building data throughout the facility lifecycle. Consequently, VA places significant importance on the accurate creation, management, and stewardship of building information during project creation, and expects that data created during planning, refined during the project execution process, will be reused in facility management. BIM Model(s) shall be provided at the end of construction that can be used for this purpose.

2.4 Terms of Use

The terms Design Team, Construction Team, and Design/Construction Team have been used in this manual to assist in defining which group the guidance applies to. However, because the acquisition strategies can define risk differently, for some projects the responsibility will shift to different either the AE or Contracting entity, or both. The VA Contract should properly define the duties of the parties before BIM modeling begins.

2.5 Additional Tools

To facilitate BIM development, the VA has provided the **Object Element Matrix** that defines object and element properties and attributes by Uniformat/OmniClass classification and Level of Development (LoD).

2.6 Open Standards

To ensure the life-cycle use of VA building information, VA requires that information supporting common industry deliverables be provided in existing open standards, where available. For those contract deliverables whose open standard formats have not yet been finalized, the deliverable

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[2] OmniClass, Uniformat, and Masterformat are national construction classifications provided by the Construction Specification Institute)

[3] GUID – Globally Unique Identifier, which is a unique code identifying each object/space. A GUID should not be confused with "code" in "room code," "equipment code," or "space code." The GUID assigned by the BIM authoring tool persists through room name changes and various other modifications, allowing the object/space to be tracked throughout the project execution process.

will be provided in a mutually agreed upon format which allows the re-use of building information outside the context of the proprietary BIM software. The formats used will be specified in the BIM Management Plan and shall include, at a minimum, the following standards:

a. Current version IFC Model View Definition (MVD) formats:

- Coordination---This format will be required for all deliverables needed to demonstrate the coordination of design disciplines prior to construction or the coordination of construction trades supporting the efficient fabrication, staging, and installation of fabricated building elements. In addition to the Coordination View file(s), where required the designer and contractor shall provide a report highlighting automatically detected (hard and soft) collisions and identifying those collisions that require further work by the design or construction team.
- Facility Management---Portions of this life-cycle oriented data format will be required for a variety of different building information deliverables that will replace paper deliverables. The deliverables for the FM Handover MVD in COBIE format include, but are not limited to:
  - Verification of the design solution against the Program For Design
  - Scheduled building and medical equipment lists
  - Construction submittal register requirements
  - Identification of installed equipment and all tagged building products
  - Facility handover deliverables

b. Portable Document Format: Copies of all approved submittals and other documents normally provided in traditional paper-based formats will be provided in PDF format. Documents authored directly by the project team shall be transformed to PDF to allow selection of text within the document. Documents authored by others, but used by the project team such as manufacturer product data sheets, will be provided the format made available by the manufacturer or scanned as image-based PDF documents.

3. BIM Management Plan (BMP)

VA requires a **BIM Management Plan (BMP)** developed to provide a *master information/data management plan and assignment of roles and responsibilities* for model creation and data integration at project initiation. The BMP shall align the project acquisition strategy needs and requirements with the PFD, VA technical standards, team member skills, construction industry capability, and technology maturity. Through this process, the team members and VA project management shall jointly agree on how, when, why, to what level, and for which project outcomes BIM will be used.

In those projects where construction information is available during the design phase (using the DB or IDC project execution strategies), the BMP shall address both design and construction activities. Where DBB execution strategy is used, a separate BMP for design and for construction shall be developed and submitted to VA with specific attention to model and data handover from the design team to the construction team.

The BMP should be considered a living document and shall be continually developed and refined throughout the project development lifecycle.

3.1 Design BMP

The Design Team shall submit the BMP to VA for review and approval before the start of schematic design. At a minimum, the BMP shall contain the following:

a. The project acquisition strategy (DBB, DB, IDC) and how the Design BIM will support the project delivery activity
b. Overall plan for achieving VA BIM requirements
c. Strategy for hosting, transfer, and access of data between technical disciplines (use of model server, extranet, access, security, etc.) A technical evaluation of the options to match the IT

technical needs of the size and complexity of the project, and to provide access by the Design/Construction Team and various VA stakeholders, peer reviewers, etc.

d. Animations/graphics showing major building equipment and medical equipment space clearance reservations for operations, repair, maintenance, replacement
e. Animations/graphics showing functionality of medical staff issues (nurses' walking distances, nurse-patient sightlines, etc), patient queuing and pharmacy deliveries, supply, processing, and delivery, etc.
f. Proposed BIM software to be used by each technical discipline team member
g. Energy modeling strategies
h. Project schedule aligned to BIM development and progress submittals per VA Submission Standards. Schedule to include:
    - Software compatibility testing schedule (if required)
    - Proposed BIM workshops and training as needed
    - Progress BIMs per Design Document Submission
i. Strategy for import of PFD VA-SEPS information and data export for Facility Management
j. File formats used for project submittal and file exchange
k. File exchange protocol
l. Strategy for establishing and managing shared file server[4], if used
m. Strategy for COBIE integration
n. Documentation of any proposed deviation from VA BIM Standards for VA approval
o. Legal status of the Design Model will have for construction (Binding, Informational, Reference, Reuse)
p. Strategy for updating and coordinating changes during construction into the final BIM model deliverable files
q. BIM qualifications, experience, and contact information for the following: BIM Manager; Technical Discipline Lead BIM Coordinators for all major disciplines (Architect, Civil, MEP, Structural, etc.)

3.2 Construction BMP

After bid award, the Contractor shall submit a Construction BIM BMP Plan, outlining the strategy and schedule for utilizing BIM Technology to execute construction related activities and project coordination. The Construction BMP shall address the following:

a. The project acquisition strategy (DBB, DB, IDC) and how the Construction BIM will support the project delivery activity. When a DBB execution strategy is used, the Construction BMP shall address the specific strategy for the Design BIM reuse.
b. Strategy for compliance with VA BIM project requirements
c. Constructability analysis with BIM
d. Animation/graphic showing installed major building equipment and medical equipment space clearance reservations for operations, repair, maintenance, replacement
e. Strategy for software compatibility, file formats, hosting, transfer, and access of data between trades (use of model server, extranet, access security, etc.) A technical evaluation of the options to match the IT technical needs of the size and complexity of the project, and to provide access by the Design/Construction Team and various VA stakeholders, fabricators, etc.
f. Proposed trade coordination strategy (clash detection)
g. Proposed use of digital fabrication
h. Updating as-built conditions in As-built/Record BIM
i. Utilization of 4D scheduling and construction sequencing technology
j. Identification of the legal status of the Design Model to construction: Binding, Informational, Reference, Reuse)
k. List of sub-contractors using digital fabrication

[4] If a VA Minor Project not using a shared file server, provide the strategy for model exchange and handover

l. Proposed BIM Software to be used by the builder and fabrication modelers
m. Strategy to assure all trade information is modeled and coordinated
n. Proposed sub-contractor BIM workshops and training integrated into project schedule
o. Integration of construction changes and commissioning data into BIM
p. Strategy for COBIE[5] integration and submittals
q. Documentation of any proposed deviation from VA BIM Standards for VA approval
r. Strategy for updating and coordinating changes during construction into the final BIM deliverable
s. BIM qualifications, experience, and contact information for the Construction BIM Manager and Lead Fabrication Modelers for all trades

3.3 Software Compatibility and Data Flow Testing

Software used for Design and Construction BIM work shall be tested for compatibility. The use of software that is not IFC compliant in the preparation of models is only permitted with the permission of VA. Versioning of software shall be managed by the BIM teams throughout the project lifecycle.

4. BIM Roles and Responsibilities

4.1 Design Team BIM Manager

As part of the execution of the Design BIM Management Plan, the Design Team shall assign an individual to the role of Design Team BIM Manager. The individual shall have sufficient BIM experience for the size and complexity of the project and shall have relevant proficiency in the proposed BIM authoring and coordination software. The individual shall serve as the main point of contact with VA and the Design Team for BIM related issues. In general, responsibilities should include the following:

a. Ensures development and compliance with the approved Design BIM Management Plan
b. Responsible for the development, coordination, publication, and verification that all necessary configurations required for seamless integration of design and construction model information have been implemented.
c. Coordinates software training and team file management
d. Coordinates the set up of shared file server with Design Team IT staff. This shall include interfacing with Design Team IT staff to set up web portal, permissions, etc.
e. Assembles composite design model for coordination meetings
f. Facilitates use of composite design models in design coordination/clash detection meetings and provides detection reports by the identification and resolution of all hard and soft collisions
g. Ensures that BIMs are used appropriately to test design requirements/criteria for functionality
h. Assumes responsibility for the proper classification of all spaces and equipment in the model to ensure direction comparison with the PFD and downstream use for facility management
i. Interfaces with Design Team BIM and IT Managers to ensure software is installed and operating properly
j. Facilitates BIM technical meetings with lead BIM Technicians
k. Determines the project BIM geo-reference point(s), and assures ALL technical discipline models are properly referenced
l. Interfaces with VA's Office of Construction & Facilities Management for data and file exchange as needed

[5] Construction Operations Building Information Exchange (COBIE) is a system for construction submittals at building turnover for operations. http://www.wbdg.org/resources/COBIE.php

m. Assures that the design deliverables specified in the contract are provided in accordance with the formats specified.
n. Assures COBIE[6] information is provided at milestone submittals and for the contractor
o. Assures proper BIM derived 2D information for paper printing as required and conforms to the National CAD standards
p. Coordinates with the builder to assure the creation of proper BIM final deliverables

4.2 Technical Discipline (Design) or Trade (Construction) Lead BIM Coordinators

All major design technical disciplines/trades (architecture, structural, MEP, interior design, etc.) shall assign an individual to the role of lead BIM Technician to coordinate their work with the entire Design/Construction Team. These individuals shall have the relevant BIM experience required by the complexity of the project and should have, as a minimum, the following responsibilities for their discipline:

a. Coordinate technical discipline BIM development, standards, data requirements, etc. as required with the Design Team BIM Manager
b. Lead the technical discipline team BIM in its documentation and analysis efforts
c. Coordinate clash detection and resolution activities
d. Coordinate internal and external BIM training as required
e. Coordinate trade items into the Design BIM (depending on acquisition plan)

4.3 Construction BIM Manager

The BMP for Construction shall identify the individual assigned to be the Construction BIM Manager. This individual shall have the appropriate level of relevant BIM experience required for the project complexity and acquisition delivery strategy. In general, responsibilities should include the following:

a. Overall responsibility for the Construction BIM model creation and information developed during construction
b. Coordinates software training and establishes protocol software for Construction Team for efficient delivery of project
c. Acts as the main point of contact for BIM and related issues between the Construction Team, subcontractors, the VA, the Design Team, and others as required
d. Provides specifications for General Contractor's BIM Coordination Room to VA for approval. Ensures that the Construction Team has necessary hardware and BIM Software properly installed and accessible for project use
e. Coordinates construction sequencing and scheduling activities, and assures they are integrated with the Construction BIM
f. Facilitates use of composite trade models in construction coordination/clash detection meetings and provides detection reports by the identification and resolution of all hard and soft collisions
g. Communicates with the Design Team, coordinates the data extraction sets required by the construction trades and ensures that these requests are met
h. Coordinates with the Design Team to facilitate design changes in the field have been documented and are updated in the BIM in a timely manner
i. Prior to approval and installation, works with Lead Fabrication Modelers to integrate 3D fabrication models with the updated design model to ensure compliance with design intent

[6] Construction Operations Building Information Exchange (COBIE) is a system for construction submittals at building turnover for operations. http://www.wbdg.org/resources/COBIE.php

j. Coordinates update of as-constructed conditions in the Final Model deliverable

k. Coordinates with Design Team and Commissioning Agent to assure COBIE information is complete

Define Role	Determine Responsibility in BIM Management Plan (BMP) Development	BIM Responsibility	
VA Project Manager	Manages and coordinates project execution and BIM to meet acquisition strategy and cost containment	Oversight	
Design Team Project Manager	Team manager and coordinator, BMP	Coordination & Review	
BIM Manager	Coordinate BIM use on project, determine schedule of use, sharing activities, quality control, modeling responsibilities and document in BMP	Oversight, Management Execution, and Model Exchange	
Architecture	Design Execution –Formulate with BIM Mgr. Map BIM use for architectural design	Modeler and Review	
Structural	Engineering - Formulate with BIM Mgr. Map BIM use for structural design – Determine BIM use for structural simulations, analysis, and documentation. Identify tools	Modeler & Review, and Model Exchange	
MEP	Engineering - Formulate with BIM Mgr. Map BIM use for MEP design – Determine BIM use for simulations, analysis, and documentation. Identify tools	Data Development Modeler, and Model Exchange	
Interior Design	Interior Design Execution –Formulate with BIM Mgr. and architect - Map BIM use for architectural design	Data Development Modeler and Model Exchange	
Sustainability and Energy	Engineering - Formulate with BIM Mgr. Map BIM use for Sustainability, 3rd Party Rating Systems. – Determine BIM use for simulations, analysis, and documentation. Identify tools	Data Development Review & User	
Medical Center Users	Determine facility functionally issues to be modeled and tested	Development of critical medical issues, review and input of testing	
Commissioning	Support. Provides architectural, engineering, equipment compliance reports produced in COBIE format	Data Development Review & User	
BIM modeling expertise by Software Application	Supports BIM manager on application specific content, issues	Modeler and Data Integrator	
Project Estimator	Supports alignment of project acquisition to BIM development & cost containment strategies	Oversight	
Contractor	Receives or helps create BIM for Constructability and handover for Field Use. Determine Interference checking responsibility	Model User and Review, and Model Exchange	
Sub-Contractor and/or Fabricator (as appropriate)	Off-Site Fabrication - Formulate with BIM Mgr. and designer. Map BIM use for fabrication and shop drawing design. Determine BIM use for simulations of maintenance space analysis, and documentation. Identify tools	Model User, Modeler, Integrator	

5. Model Sharing

5.1 Design

a. The qualifications, experience, and previous success in BIM coordination of the Proposed BIM Manager and the Design Team shall be a part of the evaluation factors for AE selection.
b. The Design Team shall be responsible for providing a fully coordinated and assembled BIM in a collaboration software format (Navisworks or equal) as well as separate copies of each technical discipline model in the original software authoring tool, as well as a 2D plan set, derived from the assembled BIM, for contract bidding.

5.2 Construction Bidding

a. The qualifications, experience, and previous success in BIM coordination and fabrication of the proposed Construction BIM Manager, General Contractor, and major sub-contractors to achieve VA's BIM objectives shall be a part of the evaluation factors for contractor selection.

b. During bidding, the use of BIM Standards will be announced and reviewed with potential bidders, and then reviewed with the selected General Contractor and major sub-contractors prior to the start of construction.

c. **The Contractor shall have access to the Design BIM during bidding and construction.** The solicitation for bids shall define the legal status of the model to the bidders (binding, informational, reference, etc.) by determining the Contract Record Document (the BIM model(s) or the extracted 2D plan set). This decision will be made on the basis of VA business interests, the maturity of the market for BIM use, and other factors.

d. Regardless of whether or not the Design BIM model(s) is the Contract Record Document, after a contract is awarded for construction the coordinated design BIM and all native BIM files shall be provided to the appropriate contractor entities as needed.

5.3 Construction Phase

a. It is the Contractor's responsibility to assure that all major trades are modeled and used for clash detection, construction phasing, and installation coordination.

b. Contractor's fabrication models shall be coordinated with the design model. Any conflicts to the design model that need to be made prior to fabrication and construction shall be reported to the Design Team in the form of a Request for Information (RFI). Clash reports may also be issued by the General Contractor as background information for RFI's and submittals.

6. Collaboration Procedures

The success of a BIM enabled project delivery process is highly dependent upon the level at which the entire Design/Construction Team can communicate and work collaboratively for the duration of the project. This section documents collaboration procedures for effectively managing this process.

6.1 Project Kickoff BIM Standards Orientation

Upon award of the project, the VA shall facilitate a Pre-Negotiation Project Kickoff Orientation Meeting, which will review all VA requirements including those that apply to BIM and answer questions from the Project Team.

6.2 BIM Coordination Room(s)

A BIM Coordination room shall be provided during design and during construction for facilitating BIM design review and clash detection/coordination where all the team members can meet to discuss technical discipline coordination issues using the BIM models. Depending on the project acquisition strategy, there may be one room or there may be two rooms in succession.

Alternatively, collaboration meetings using web conferencing (webinar) is acceptable for facilitating these meetings. During Construction, the BIM Coordination Room shall be located at or near the construction site to coordinate fabrication models with respective trades.

For each BIM Coordination Room, appropriate equipment and tools shall be provided. Smart boards may be used to view documentation (2D and 3D), create mark ups interactively, archive the latter, and convert them to RFIs or other relevant reference documents.

7. VA Requirements for Using BIM

At a minimum, BIM shall be used for the following:

7.1 Space and Medical Equipment Validation

VA-SEPS Data Required in BIM: VA uses the *Space and Equipment Planning System* (*VA-SEPS*), which is a data based planning tool shared by the VA, U.S. Navy, Army, and Air Force to create a Program for Design (PFD). Information regarding medical need requirements is entered to generate the space requirements and medical equipment associated with that space for a particular project. The output of VA-SEPS is a PFD containing a list of rooms (spaces) and medical equipment, with their identifying computer codes used to associate and track this information through design and construction.[7] Some of these codes will ultimately be imported into the facility management software to provide VA with the ability to manage, track, and report on VA's spatial inventory, medical equipment, and building equipment. In addition, the BIM software will automatically assign a unique GUID to spaces which will identify each individual space.

The BIM is required to capture this space and equipment data in the BIM model. All BIM modeling must preserve the field name designations and text values found in the VA-SEPS BIM export files[8]. To do this, the final PFD for each project *must* be electronically exported from the VA-SEPS database for import and reuse in BIM. A spreadsheet export can be obtained in VA-SEPS by going to the Selection Tree and clicking on *Select a Project*, then choosing the proper project. Then on the sub-menu, select *Export Project Data to BIM*. This will create a MS Excel file with the associated data codes, which can then be imported into the BIM software's "space" tool and equipment data into "elements" or "objects" tools appropriate to the particular BIM software, or the data can be linked in a database external to the BIM software. Medical spaces and medical equipment shall be derived from the model and validated against the PFD electronically at each submittal stage.

Note that if the original PFD was not developed using VA-SEPS or if new spaces are added during the design process, then a new VA-SEPS-PFD export must be created to obtain the proper codes.

7.2 Architecture – Spatial and Material Design Models

The timing of the Level of Development (LoD) required for elements(s) or systems(s) will be dependent entirely upon the project execution strategy used for the project, as the deliverables and their timing will be different for DBB than for DB or IDP.

The *Object Element Matrix* shows the evolution of the architectural spatial model as it is refined during the design process as the project progresses toward construction. As materials and components are selected, generic assemblies shall be assigned material properties, sizes, sustainability credits tracked, and other specific component information defined to clearly identify

[7] Additional space engineering criteria will be added over time.
[8] With the exception of "Army_Cat," "Navy_Cat," and "USAF_Cat," which can be removed.

building features such as walls, floors, roofs, doors, and windows. The program space requirements shall be modeled in the spatial model and validated electronically against the PFD at each stage of the project and submitted with the required deliverables.

7.3 Energy Analysis

Energy simulation and life-cycle cost calculations shall be based on information extracted directly from BIM and validated by energy modeling. The models shall be created to a Level of Development (LoD) and quality as required to perform an energy analysis appropriate for the phase and decision requirements of the project. When internal spaces are defined, they shall be modeled with internal environment parameters for early MEP design.

Design Teams shall utilize energy modeling and sustainable design software that extracts BIM data to the appropriate file format for the analysis tool.

7.4 Design Visualization for Communication, Functional Analysis, and Constructability

BIM provides the opportunity to build a virtual building and to virtually test that building for functionality during design. This allows project stakeholders to see and understand design solutions that represents reality so they can work towards improving the building design before construction starts. VA is open to innovation and encourages the Design Team to find efficiencies and uses for BIM to enhance communication for the project. At a minimum, the model shall be integrated into design reviews, review submittals, and 3D construction documentation views. Areas that would benefit from the use of 3D imagery and fly-throughs during the design process and during construction shall be identifed and noted in the BMP(s).

Visualization tools refer to animations, fly-throughs, static 3D renderings, 4D process sequencing, and other techniques to assist decisionmaking and comprehension. It should be noted that even though the BIMs contain most of the source information needed for visualization, they may require further refinement in specific animation and visualization software to accomplish the intended results.

During design, special consideration must be given to medical staff and maintenance issues. At a minimum, BIM shall be used to validate:

- Nurses' walking distances
- Nurse-station sightlines
- Process areas where timing and volume may be problemmatic (such as patient queuing for waiting rooms and pharmacy, pharmacy delivery routes/timing
- Supply, Processing, & Distribution (SPD)
- Animations/graphics showing major building equipment and medical equipment space clearance reservations for operations, repair, maintenance, replacement
- Color coding of floorplates for determining medical room/department locations and square footages, and circulation
- Constructability

The Design and ConstructionTeams are encouraged to explore options to use the BIM and other electronic tools to enhance the project quality and delivery times, including quantity take-offs, cost estimating, overall project scheduling, subcontractor coordination and manpower loading, off-site fabrication, and other widely discussed BIM benefits.

7.5 Building System Models – Structural, MEPF,[9] and Interiors

Structural, MEPF, and interior design information is required to be developed in BIM.

7.6 Masterplan Space Scheduling and Sequencing – 4D

For design work that includes sequencing of renovation swing space or masterplanning for long-term build-out, BIM 4D shall be used to illustrate the phasing plan to interact, communicate, and get approval of the final design and spatial sequencing with the medical staff.

7.7 Communication of Construction Scheduling and Sequencing - 4D

The Contractor shall link BIM to the project schedule as a communication method to coordinate with the Medical Center and the VA Resident Engineer logistics that affect medical center operations or require shutdown of any affected facilities and utilities. The animated phasing plan shall address such issues as swing space during construction, parking interruptions, and re-routing of pedestrian/vehicular traffic, or any other construction work that could affect Medical Center operations.

It is recommended that the Contractor also use BIM - 4D in schedule planning and communication with the subcontractors and to understand the impact to the construction schedule of other changes during the duration of the project.

7.8 COBIE/Commissioning

VA has adopted COBIE as the methodology to electronically transfer building information after construction is complete for facilities management. The COBIE spreadsheet (see COBIE2 Template) is part of the *U.S. National Building Information Model Standard (NBIMS).* Third-party utilities facilitate the automatic creation and transfer of some data between BIM and a COBIE spreadsheet via IFC files as an intermediate stage, and some BIM software may include creation of and data transfer to the spreadsheet directly without making use of intermediate IFC files. Where possible, automatic means should be used to create and fill in the COBIE spreadsheet.

The Design/Construction Team shall consult their BIM software vendor(s) for the most current COBIE utilities. However, the completed COBIE worksheets will also contain some information that is entered manually into the electric file, either because the information currently cannot be conveniently extracted from the BIM or because it does not reside in the BIM.

The Design/Construction Team is encouraged to provide as much information in COBIE as is known at the time of the deliverable. The required worksheets in COBIE will be filled out in step with the LoD and Design Phases (see Object Element Matrix).

- The Design/Construction Team(s) shall submit the most current version of the COBIE spreadsheet with other required deliverables at each Project Phase.
- With CD deliverables, the COBIE[10] Type and Component worksheets are required. These fields provide component Name, Description, and Creation Date. The medical equipment listed in the VA-SEPS-PFD export shall be noted on the COBIE spreadsheet.

[9] Mechanical, Electrical, Plumbing, Fire protection (MEPF)
[10] www.wbdg.org/pdfs/cobie_spreadsheet.pdf

7.9 Clash Detection/Coordination

a. General

- It is the Design/Construction Team's responsibility to conduct and manage an adequate and thorough Clash Detection process so that all major interferences between building components will have been detected and resolved before construction. It shall the goal of the Design/Construction Teams to reduce the number of changes during construction due to major building interferences to zero.
- The BIM Manager shall assemble a composite model from all of the model parts of each design discipline for the purpose of performing a visual check of the building design for spatial and system coordination. Vertical shafts should also be reviewed to ensure that adequate space has been allocated for all of the vertical mechanical systems and that all of the shafts line up floor to floor. Prior to each scheduled coordination meeting, an updated clash report will be issued by the BIM Manager to the technical discipline consultants.
- On a multistory project, the models may need to be split on a level-by-level basis for MEPF coordination. If a floor is particularly large, it may also need to be split by zones to reduce file size. Typically, 3D clash detection/coordination continues on a single floor until building systems are fully coordinated, and then continues on the next floor up.
- Coordination software shall be used for assembling the various design models to electronically identify, collectively coordinate resolutions, and track and publish interference reports between all disciplines. The technical disciplines shall be responsible for updating their models to reflect the coordinated resolution.
- The team shall review the model and the Clash Reports in coordination meetings on a regular as-needed[11] basis throughout the design phases until all spatial and system coordination issues have been resolved.
- During the construction phase, the accuracy of fabrication models shall be verified. Prior to each fabrication submittal for approval, fabrication contractors shall submit their models to the Contractor's BIM Manager for integration and clash detection/coordination and resolution.
- Internal Clash Resolution – Design Consultants and Subcontractors who are responsible for multiple scopes of work are expected to coordinate the clashes between those scopes prior to providing those models to the BIM Manager for spatial and system coordination.
- Spatial Coordination Verification: Verification and tracking of resolved conflicts of all trade coordination issues which could result in change orders or field conflicts shall be provided to VA during project milestone dates, and should be fully resolved before bidding.
- For ease of identification during the 3D Clash Detection/Coordination process, it is recommended that the following trades be represented in these assigned colors:

Trade colors for Clash Detection

Architecture: White
Structural Steel: Maroon
Concrete: Gray
HVAC Equipment: Gold
HVAC Supply Duct/Diffuser: Blue
HVAC Return Duct/Diffuser: Magenta
HVAC Pipe: Gold

[11] Generally this is weekly

Electrical Equipment: Dark Yellow
Electrical Conduits: Light Yellow
Communication Conduit: Light Blue
Electrical Cable Tray: Dark Orange
Electrical Lighting: Yellow
Plumbing Water: Cyan
Plumbing Sewer: Magenta
Plumbing Storm Drain: Green
Fire Protection: Red
Pneumatic Tube: Dark Green
Equipment (Medical): Light Green
Medical Gas: Light Green
Security Systems: Orange
Fire Alarm: Fuchsia

b. Minimum Requirements for Spatial Coordination and Clash Detection

1. **Architecture + Structural:** Below-grade spaces, proposed floor plates with major penetrations, floor-to-floor heights, beam clearances, heavy utilities locations, floor loads, core, and vertical shafts, beam depths and required clearances, patient lift mechanisms, slab thickness, columns, column caps, and seismic bracing. Provide adequate space for construction and maintenance access to structural elements, building equipment, and distribution systems.
2. **Architecture + MEPF:** Structural and space elements, flow and isolation requirements, proposed functional area configurations, floor-to-floor heights, fire containment, vertical and horizontal transportation. Possible future expansions shall be considered and shall be clash-free.
3. **MEPF/HVAC + Architecture, Structure, and Telecommunications:** Main distribution and collection systems, configurations and sizes for piping, duct, conduit, power wiring, blowers; diffusers; intakes, large compressors. Clearance reservations for equipment maintenance filter removal, and equipment removal and replacement shall be modeled with the equipment, and sign-off on the adequacy of the space reservations shall be obtained from the facility Chief Engineer.
4. **Architecture + Life Safety Fire Protection:** Safe zone and fire suppression pipe location, egress paths and exit distance requirements, equipment, and pipe penetrations.
5. **Medical Equipment + Architecture, MEPF, HVAC, Structural:** Medical major equipment positioning and location requirements, medical gases distribution and waste collection, cryogen supply piping for MRI and labs, and cryogen cooling compressors, nurse call systems, public communications, and building controls. This includes major medical equipment adjacencies and shielding barriers, pipes, and venting and air intake locations and other limitations.
6. **Architecture/HVAC + Interiors:** Merges shall include ductwork and piping + ceilings and FF&E[12] + HVAC.
7. **Space Validation:** There shall be no space gaps. Bounding boxes used to represent room and zone spaces shall match with architectural requirements and data values, and all shall be coordinated with values given in the PFD.
8. **General Model Quality Checking:** All walls shall be properly joined to prevent “space leaks” in areas defined by enclosing walls. Bounding boxes shall not conflict.
9. **Security:** Security setbacks + structure + site.

[12] Fixtures, Furniture, & Equipment (FFE)

10. **Accessibility Compliance:** Wheelchair pathways and clearances + structure. (If using Solibri Model Checker or other rules-based model checking software, accessibility compliance can be checked automatically.)

7.10 Virtual Testing and Balancing

The VA requires virtual testing and balancing of the architectural model to support sustainable building systems design and analysis. Room data can be read from the linked architectural model to create mechanical spaces (each space is the same as the room in the architectural model). Multiple spaces are joined to create zones. This data can used to calculate native heating and cooling analysis that is built into the MEP software or exported using gbXML to an external analysis application such as eQuest, Trane/Trace, or DOE based analysis programs. AEs can then bring this data back within the model to check their work. One of the methods is to create a Space/Room schedule that will show calculated air flow vs actual air flow. See figure below. All air flows can be checked for load balance to the terminal box and all the way back to the air handling units. Check with MEP modeling software companies for additional information.

Space Airflow Schedule

Number	Name	Calculated Supply Airflow	Actual Supply Airflow	Airflow Delta
System Type	Type	Mark	Flow	
115	Instruction	1457 CFM	1470 CFM	13 CFM
Supply Air	24x24 - 8 Neck	SD 1-12-109	360 CFM	
Supply Air	24x24 - 8 Neck	SD 1-12-110	450 CFM	
Supply Air	24x24 - 8 Neck	SD 1-12-111	330 CFM	
Supply Air	24x24 - 8 Neck	SD 1-12-112	330 CFM	
116	Conference	580 CFM	0 CFM	-580 CFM
117	Instruction	523 CFM	0 CFM	-523 CFM
118	Electrical	45 CFM	0 CFM	-45 CFM
119	Sprinkler Main	57 CFM	0 CFM	-57 CFM

7.11 Additional BIM Uses

VA is interested in fostering and supporting innovation, and encourages bold steps toward trying new ways to improve business process efficiency, design, and project outcomes. VA does not wish to unduly hamper creative ideas and is interested in proposals to achieve these goals.

Following are some of the discretionary areas that VA supports for further development and the use of BIM; other ideas may also be proposed by the AEC teams:

- Evaluating physical security & survivability
- Early MEP design
- 3D – Virtual functionality viewing and testing of the design
- 5D – Material take-offs & cost estimating
- Creating a interactive virtual workspace for the Design Team to achieve integrated design goals
- Integrating information, e.g., electronic specifications that are tied to the BIM
- Achieving automated code checking
- Repeatable modular construction components to speed construction erection time
- Modular construction & off-site fabrication

8. 3-D Models, Formats, and Model Structures

8.1 General

The BIM(s) shall consist of objects and elements that represent the actual dimensions of the building elements and the building equipment that will be installed on the project. Before modeling begins, the BIM Manager will work with the Design Team to develop the model and model view extraction structure for all the construction document files to assure coordination between disciplines. This structure shall be provided to VA so that the models can be reconstructed at a later date. BIM coordination requires the following model structure and features:

a. The BIM Manager shall establish the floor elevation protocol so that the Technical Discipline/Trade BIMs will be modeled at the correct elevation.

b. Clearance Reservations: All models shall include separate 3D representations of required clearances for all mechanical equipment for repair, maintenance, and replacement, light fixture access, overhead cable tray access, etc. These clearance/access models should be in a separate layer(s) for each trade clearly labeled as such.

c. The granularity of elements in the model shall correspond with the proposed sequence of the installation at the site (e.g. not one wall element for the entire floor).

d. All 3D model files submitted for clash detection shall be “clean;” all extraneous 2D references and/or 3d elements must be stripped from the models.

e. When emailing notification of file uploads or for any other email correspondence pertaining to the project, all email subject line headings must be prefaced with the acronym for the Project Name.

8.2 Subcontractor Coordination

Prior to installation, the Contractor shall hold trade coordination meetings with subcontractors. The coordinated model will be used to review and optimize scheduling and field installation. Subcontractors will be expected to have individuals attend who can actively engage in the subcontractor coordination process and make schedule commitments.

8.3 Digital Fabrication

The collaborative process will ensure that the deep knowledge and associated efficiencies of the fabricator are embedded into the Construction Model(s). The following construction trades (at a minimum) shall provide 3D fabrication models with parametric model objects:

Structural Steel
Mechanical System Duct
MEP subcontractors (incorporate vendor models if available)
Curtain Wall
Building Envelope Systems (rain screens, pre-cast panels, glazing systems)
Casework and furniture systems
Any additional fabrication models generated by subcontractor

9. Technology Platform and Software

9.1 Approved BIM Software for VA Projects[13]

VA accepts object oriented software applications that comply with current industry interoperability standards and are able to be used in a collaborative environment. All software platforms used for VA projects shall be compliant with:

- The most current version of Industry Foundation Classes (IFC) file format
- Commercially available collaboration software that provides interoperability between the different software applications (see below).
- Traditional 2D documentation shall be prepared with approved IFC compliant BIM authoring software and plans, elevations, sections, schedules, and details shall be derived and fully coordinated with the coordinated building model. All other documents are to be submitted per the VA contract requirements.

TYPE (These are general categories. Listed software can be used for more than one "Type.")	**SOFTWARE** (no order of preference)
Planning/Preliminary Cost Estimates	VA-SEPS, Onuma Planning System (OPS), DProfiler, Tokmo, CodeBook
Authoring – Design (Architecture, Structural)	Revit Architecture, Bentley BIM, ArchiCAD, Tekla, Vectorworks
Authoring – MEPF (Engineering & Construction)	ArchiCAD MEP, Revit MEP, AutoCAD MEP, Bentley BIM, CAD-Duct, CAD-Pipe, AutoSprink, PipeDesigner 3D
Authoring – Civil	Bentley Inroads and Geopak, Autodesk Civil 3D
Coordination (clash detection)	NavisWorks Manage, Bentley Navigator, Solibri Model Checker, Horizontal Glue, EPM Model Server, BIMServer
4D Scheduling	Synchro, Vico, NavisWorks Simulate, Primavera, MS Project, Bentley Navigator
5D Cost Estimating	Innovaya, Vico, Tokmo
Specifications	Speclink-e, E-Specs
Model Checking Validation, IFC File Optimizer	Solibri or equal
COBIE	Tokmo COBIE exchange
Energy Analysis[14]	EcoDesigner, Ecotect, eQuest, Green Building Studio, EnergyPlus, Trane/Trace, DOE2

10. Modeling Requirements

10.1 General

a. BIM shall be used for all building systems design, development, and analysis, including but not limited to architectural, structural, mechanical, electrical, plumbing, and fire suppression, etc., as noted in this manual.

b. During Concepts, SD and DD Phases, BIM technology shall be used to develop and establish building performance and the basis of design in accordance with VA Standards. The model shall be interoperable with analytic tools including but not limited to building

[13] Software other than those listed may be used subject to the above compliance requirements and with VA approval.
[14] BIM based energy analysis software used should support IFC import or be a native BIM model format that is IFC compliant. Energy analysis software selection shall be based upon U.S. Department of energy Recommendations and ANSI/ASHRAE 140-2007 (or latest version).

envelope, orientation, daylighting, energy consumption, building management system (BMS), building automation systems (BAS), renewable energy strategies, life cycle cost analysis, and spatial requirements.

c. Use BIM authoring software element libraries when creating model objects. Model objects shall contain parts and components as opposed to simple 3D Geometry (e.g., walls, doors, windows, railings, stairs, and furniture, etc.).

d. Model objects shall contain IFC parameters and associated data applicable to building system requirements. These elements shall support the analytic process include size, material, location, mounting heights, and system information where applicable. As an example, a light fixture may contain several parameters such as energy output requirements, user illumination levels, make, model, manufacturer, and bulb life.

e. The Contractor shall utilize model geometry and extract graphical information for generating construction administration documents from the Project BIM (RFI's, Directives, Bulletins, and Change Orders, etc). The Contractor shall record as-built conditions in BIM as part of final delivery to VA.

f. Submittal drawings, calculations and analysis shall be extracted from the coordinated BIM.

g. Elements, objects and equipment shall be tagged with unique identifiers (GUIDs).

10.2 Types of Model Elements

Model elements shall be derived from the following sources:

a. Manufacturer's Model Elements - elements created by and acquired from manufacturers often have more information than is prudent to keep in the BIM model; the *appropriate* level of detail should be retained for the design element. However, embedded performance data shall remain for analysis and specification purposes.

b. Custom Created Model Elements – custom model elements that are created must utilize appropriate BIM Authoring tool templates to create custom elements. Custom models components need to be assigned as a part and part of a family or group.

10.3 Model Geographical Location

The spatial coordination (coordinates) of the master BIM file shall be set at the beginning of the project. Once established, spatial coordinates shall only be changed by mutual consent of the team and the VA project manager, with the matter recorded in the meeting minutes and the BMP. Once the design coordinate system is agreed upon, any model(s) of existing buildings relevant to the project shall be converted into the coordinate system used for each designed building.

As is standard practice, the VA requires that a building within a BIM file include a geo-reference to accurately locate that building within the site and to give it a physical location context at larger scales. The BIM Manager shall geo-reference site plans and building models for site layout surveying and future GIS use in accordance with the State Plane Coordinate system where the project is located. The BIM file point shall be located at the SW corner of the structural grid.[15]

[15] The USGS Reference will always "read" as 0,0,0 – the project base point will read whatever the distance is from the USGS Reference to the lowest left hand point of the building structural grid.

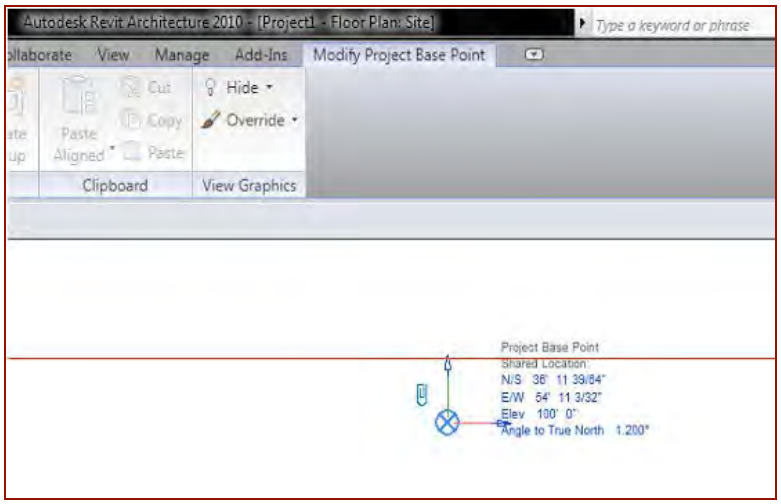

Figure 1- Model Reference (Example: Revit)

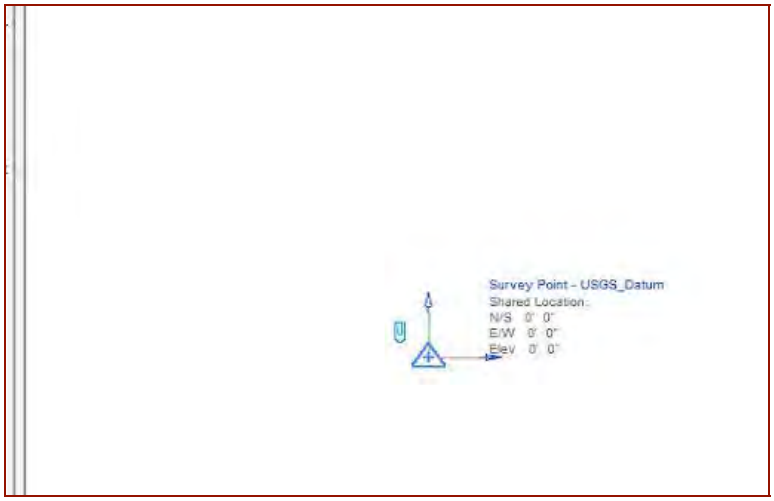

Figure 2- USGS Datum (Example: Revit)

10.4 Points of Reference

The BIM Manager shall provide a 3D grid for incorporation into the spatial coordination model. This will provide the viewer with a quick point of reference when navigating through the model. Room information shall also be incorporated.

10.5 Requirements for Modeling Space

a. Space information imported from the VA-SEPS-PFD Export shall be the source for space creation in BIM.[16]

b. Areas of four square feet or greater shall be tracked and identified by name, even if those spaces are not listed in the VA-SEPS-PFD export.

c. Spatial data shall be generated and associated with bounding elements (walls, doors, windows, floors, columns, ceilings).

d. The Net Square Footage (NSF) shall be modeled for each functional space in the PFD, using the appropriate space/object BIM tool to capture and carry the information. Spaces shall be represented and broken down into functional spaces (i.e., Medical Exam Room, Laser Treatment Room, Waiting Room, etc.) as defined in the PFD even though they may be parts of a larger physical space. A physical space may contain several areas that are treated individually in the PFD spatial program. If two areas have different functional space classifications, even though they are within the same physical space, they shall be modeled as two separate spaces. For example, there may be a security checkpoint area within a lobby: the security checkpoint area and the remainder of the lobby area shall be modeled as separate non-overlapping spaces. These spaces might also be grouped into a Zone, for visualization and analysis purposes (e.g., to differentiate private vs. public zones, for thermal simulation calculations). Some BIM-authoring applications have several ways to create space objects. Users should consult with the BIM-authoring application vendor to learn the recommended method for creating space objects that will be exported to an IFC BIM.

e. Space/area schedules and diagrams must be dynamically updated from the model geometry.

f. VA PFD Spatial Requirements must be validated through reports generated from the BIM.

10.6 Space Naming and Coding

Each space shall include the following attributes and be maintained throughout the Design and Construction BIM models:

a. Building
b. Wing
c. Floor
d. Department
e. Sub-department
f. Space Name – *English Name & Abbreviation*
g. Room Number – *VA Wayfinding Room Number*
h. Room Number – *Construction Document Number (used on large complex projects for builder use)*
i. Space Code – *VA-SEPS Room Code*
j. Unique Space Number – *GUID*[17]
k. Space Type - *OmniClass*[18]

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[16] Other sources are program narrative, VA Design Guides, and other directives.

[17] Globally Unique Identifier (GUID). GUIDs must be preserved through generation and regeneration of IFC deliverables so that a given object (space, equipment, etc) can be tracked properly. GUIDs are automatically assigned by BIM software. BIM software documentation should be consulted to determine how copied equipment object instances are handled in outputted reports and how they are handled internal to the software.

[18] All spaces, medical equipment, and building equipment and systems shall have an OmniClass code assigned. Use the OmniClass codes provided in the VA-SEPS-PFD Export, or if not in the PFD then apply the appropriate OmniClass designation. Use OmniClass Tables 13, 14, and 23 as appropriate, or consult with the Construction Specifications Institute (CSI) for latest tables that apply.

l. Space Type - *Uniformat*
m. Space Measurement - *Net Square Footage (NSF),*[19] *Department Net Square Footage (DNSF), Department Gross Square Footage (DGSF), and Building Gross Square Footage (BGSF)*

10.7 Medical and Mechanical Equipment, Etc. Coding

Each individual piece of medical equipment and building mechanical equipment shall include the following attributes and be maintained throughout the Design and Construction BIM models:

a. Item Name – *English Name & Abbreviation*
b. Item Code - VA-SEPS *Joint Services Number (JSN)*[20]
c. Unique Item Number - *GUID*
d. Item Type – *OmniClass*
e. Item Tracking Number – *Category Stock Number (CSN)* [for medical equipment]
f. Blank field for ECRI code or other (to come later)
g. Other data available from VA-SEPS that is accommodated by the COBIE[21] spreadsheet and is appropriate to the LoD for the submission phase.

10.8 Final BIM Deliverables

It is VA's intention to use the BIM model for Facilities Management upon Occupancy. Information that matures during the construction process is to be captured in the appropriate models on an on-going basis throughout the construction phase. The use of these models is a developing methodology, and presently, multiple formats of information are required.

Upon Substantial Completion, BIM files shall be summated to the VA, and shall be cleaned of extraneous "scrap" or "working space" layers, stories, abandoned designs, object creation and testing places, empty layers, and other content which is typically produced in BIM production.

Unless the project acquisition strategy realigns these responsibilities, VA shall receive the following:

3D Geometric Deliverables – Construction Coordination Model

The Contractor shall be responsible for providing VA consolidated as-built Model(s) for all building systems. The Model(s) shall be fully coordinated and align with the Design Model for architecture and structure; the required instructions on file/folder setup shall also be included:

1. Contractor – Native file formats of the final consolidated as-built Model(s) for building systems used in the multi-discipline coordination process (version as agreed in BIM Management Plan)
2. Contractor – IFC file format of the consolidated building systems models (version as agreed in BIM Management Plan)

[19] The area bounded by the inside face of surrounding walls, minus the area bounded by the outside faces of any contained full height column, *GSA Building Information Modeling Guide Series: 02 – GSA BIM Guide for Spatial Program Validation, v 0.96,* (April 2007) §2.1.2
[20] Joint Service Number (JSN) is used in VA-SEPS for associating the correct medical equipment to the proper room.
[21] Construction Operations Building Information Exchange (COBIE).

3D Geometric Deliverables – Design Intent Model

The Design Team is to ensure that the "Design Intent model" remains current with all approved bulletins for overall scope. It is NOT expected that product specific information will be added to this model. Provide the Model information for architecture and structure and the required instructions on file/folder setup:

1. Design Team - Native file format(s) of Design Model (version as agreed in BIM Management Plan)
2. Design Team - IFC file format (version as agreed in BIM Management Plan)

Data Deliverables

1. Contractor – Provide COBIE database file containing room and product data information described in previous sections of this document.
2. Design Team – Provide room/space data in COBIE format to be included in Contractor COBIE database.

2D Deliverables

1. Contractor – Provide As-built drawings in PDF format with fully bookmarked pages.
2. Design Team – Produce one printed set of final documents generated from the Design Intent Model
    a. In PDF format with fully bookmarked pages.
    b. DWG format (latest current version) with bound views to each sheet.

Digital Deliverables

All digital deliverables are to be submitted on DVD/CD with the data clearly organized and software version(s) labeled.

11. Files, Security, Waivers

11.1 Project Folder Structure

Maintaining consistent file naming and structure is critical for referenced (linked) files to function properly across Design Teams and for end users such as facilities managers to retrieve files quickly once the project is complete. For this reason, the Design and Construction Teams shall define a file protocol for the team when the BMP(s) is developed.

a. **BIM Folders**

BIM Files shall be sorted by model files and sheet files.

- **Model Files -** Original files from other disciplines should be linked from their discipline folder location and relative path to models. Model file names shall follow file naming convention outlined in the BMP.
- **Sheet Files -** PDF and native file formats of the most current sheets shall be maintained in this folder and organized with sheet file naming outlined in File Naming and Numbering of VA CAD Standards.

b. **Support Files** -Standard items needed for the project, such as a project specific symbols, applications (lisp, script, etc.), logos and graphics. Project Specific Model Content can also be placed here.

c. **Coordination Files** – Files for Construction coordination (clash detection) shall be managed by the BIM Manager, and organized by date as the project progresses.

d. **Other Folders -** Renderings, analyses, LEED, etc., will have their own folders.

11.2 Data Security

Design Teams shall establish a data security protocol to prevent any possible data corruption, virus “infections,” and data misuse or deliberate damage by their own employees or outside sources. Both the Design Team and Construction teams shall establish adequate user access rights to prevent data loss or damage during file exchange, maintenance, and archiving.

11.3 Waivers

Situations could arise where adherence to this standard may be problematic. If such a situation arises, the party creating the data must request a waiver. The VA is not opposed to such requests, but the request must identify the specific standard for which the waiver is requested, the reason for the waiver, the resulting impacts on the use of the data for the purposes VA intends, and any alternative approaches that should be considered. The VA Office of Construction and Facilities Management will make every effort to resolve these requests in a timely manner.

12. Drawing Requirements for Paper Printing

12.1 General

2D CAD drawing information for the purposes of assembling a printed set of plans shall be derived from the BIM model(s) to the fullest extent possible. All BIM information shall be fully parametric so that all applicable information regarding fixtures and/or elements can be generated for the schedules. Where required by VA, editable text files shall be attached to fixtures/elements to aid in calculations.

The National CAD Standards and the VA National CAD Standard Application Guide shall apply with these exceptions:

12.2 Diffuser Symbols

Either graphical arrows or blank-off panels may be used to represent air flow direction for diffusers.

12.3 Font

Arial font typeface shall be used. Font sizes shall comply with the VA National CAD Standards; however, the use of 3/32" TYPE is allowed. 3/32" SCALE is allowed where large elevations or floorplates would extend over more than one sheet, but 1/8" or larger scale information shall also be provided for those areas where detail cannot be discerned at the smaller scale.

12.4 Line Styles and Line Weights

Line Styles and Line Weights: The internal software BIM Line Styles defaults shall be used instead of the NCS and VA NCS Linetype definitions. The A/E has the discretion and responsibility to edit the default line weight values of the BIM software so printed documents reflect the graphic intent of NCS and VA NCS standards.

12.5 MEP Details

Where generating 2D MEP details from the model is difficult, tagged definitions of the object based elements shall be provided.

12.6 Room Naming Abbreviations

Room names on 2D drawing sheets shall be abbreviated for legibility.

12.7 Titleblocks

The VA CAD Title Block and Information shall be adapted for BIM use by the Design Team.

12.8 Uniform Parameters for Objects

The Object Element Matrix shall be used to assure that all model object parameters follow a consistent naming convention and be a reflection of industry standards.

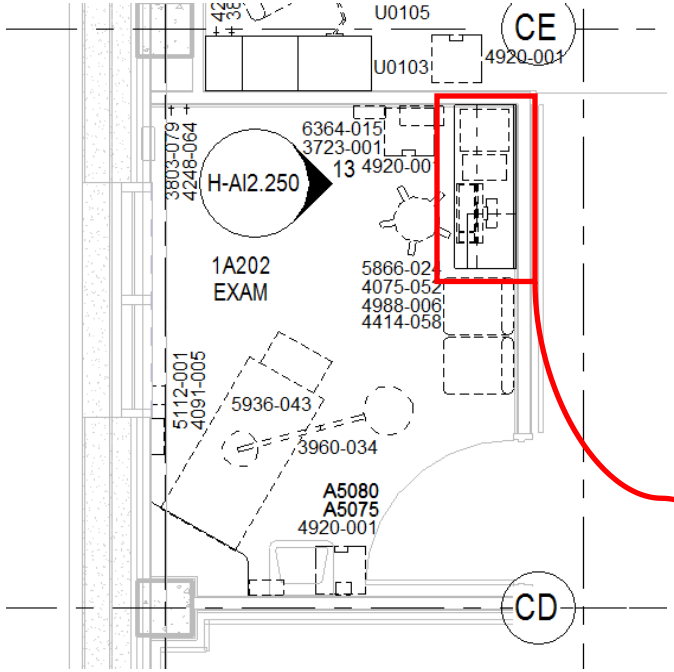
12.9 VA Standard Details

The VA Standard Details are valid as to the information the details contain, and shall be used for information regarding material and constructability content. In lieu of pulling the source images directly into the model, the Design Team shall generate this information within the BIM model allowing for object based recognition.

12.10 Casework / Millwork Finishes

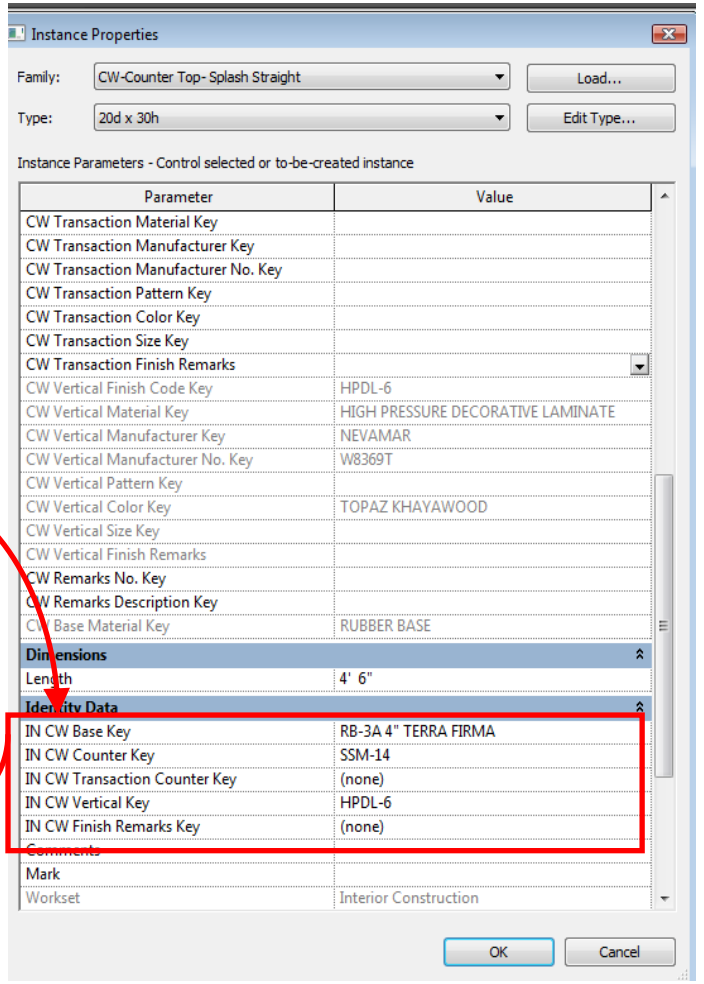
Finishes shall be assigned to the properties of the piece of casework that is inserted into the room area. Parameters are created and added to the casework properties for finish assignments.

Finishes that are assigned to the piece of casework properties shall be formatted into a Casework / Millwork Schedule to be placed on the sheet. Only rooms that have casework or millwork inserted into them will be generated in the schedule.



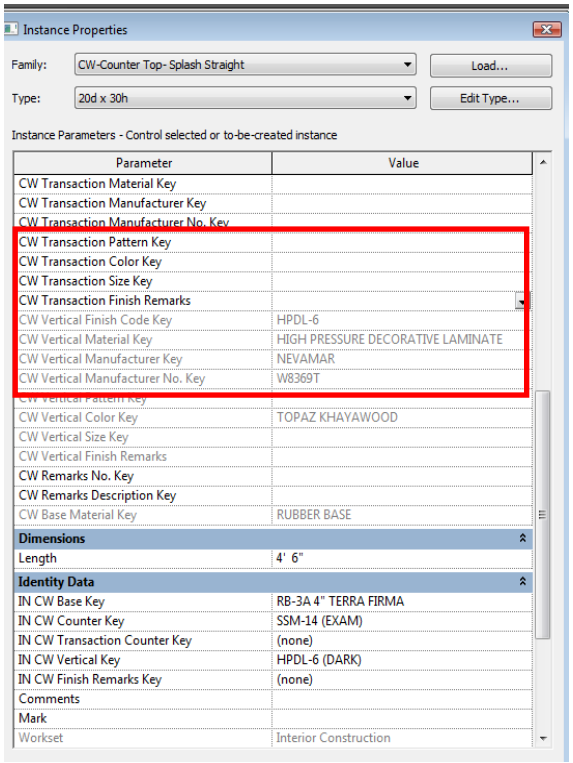
CASEWORK FINISH SCHEDULE SHEET H-IN6.521

ROOM NUMBER	ROOM NAME	BASE	COUNTER	TRANSACTION COUNTER	VERTICAL
C1					
1A101	WAITING		SSM-15		HPDL-6
1A202	EXAM	RB-3A	SSM-14		HPDL-6
1A207	NURSE STATION	RB-3	SSM-15	SSM-15	HPDL-6,16
1A216	ISOLATION	RB-3A	SSM-15		HPDL-6
1A301	TRAINING	RB-3A	SSM-14		HPDL-6
1A304	CLEAN PROCESSING	RB-3A	SSM-14		HPDL-6



12.11 Casework / Millwork Finish Legend

Material finish code and product information shall be entered into the casework properties and identified in the schedule generated from the Finish Legend.



CASEWORK AND MILLWORK VERTICAL FINISH LEGEND

FINISH CODE	MATERIAL	MANUFACTURER	MANUFACTURER NO.	PATTERN	COLOR	SIZE	ID FINISH REMARKS
HPDL-6	HIGH PRESSURE DECORATIVE LAMINATE	NEVAMAR	W8369T		TOPAZ KHAYAWOOD		
	DECORATIVE LAMINATE						
WDV-8	WOOD VENEER	KRAFTMAID		SOLID MAPLE SQUARE RECESSED PANEL, FULL OVERLAY			

CASEWORK AND MILLWORK COUNTER FINISH LEGEND

FINISH CODE	MATERIAL	MANUFACTURER	MANUFACTURER NO.	PATTERN	COLOR	SIZE	ID FINISH REMARKS
HPDL-10	HIGH PRESSURE DECORATIVE LAMINATE	WILSONART	1787-60		OXIDE		
HPDL-10 / SSM-14	MIXED MATERIAL						
QSM-5	QUARTZ SURFACE MATERIAL	CAMBRIA	1760	QUARRY COLLECTION	SUTTON		
SSM-14	SOLID SURFACE MATERIAL	CORIAN			BURLED BEACH	1/2"	
SSM-15	SOLID SURFACE MATERIAL	CORIAN			CLAM SHELL	1/2"	USE SSM-18 INTEGRAL LAVATORY, WHERE APPLICABLE
SSM-16	SOLID SURFACE MATERIAL	FORMICA	809		SMOKE ICE	1/2"	USE SSM-17 INTEGRAL LAVATORY, WHERE APPLICABLE
SSM-17	SOLID SURFACE MATERIAL	FORMICA			FROST	1/2"	FORMICA INTEGRAL VANITY, VO65
SSM-18	SOLID SURFACE MATERIAL	CORIAN			CAMEO WHITE	1/2"	CORIAN INTEGRAL LAVATORY, 820

CASEWORK AND MILLWORK TRANSACTION COUNTER FINISH LEGEND

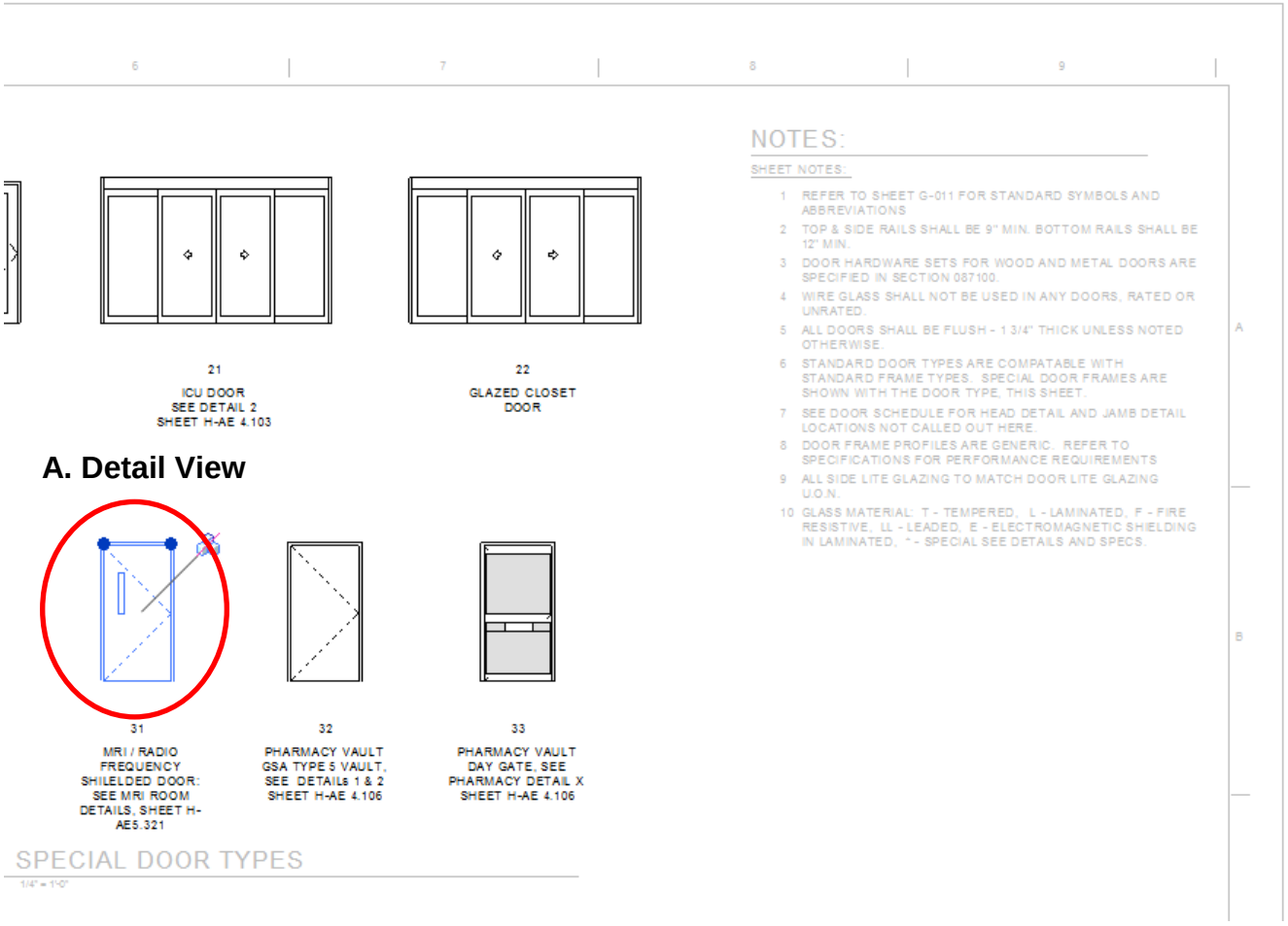
FINISH CODE	MATERIAL	MANUFACTURER	MANUFACTURER NO.	PATTERN	COLOR	SIZE	ID FINISH REMARKS
SSM-15	SOLID SURFACE MATERIAL	CORIAN			CLAM SHELL		

CASEWORK FINISH SCHEDULE SHEET H-IN6.521

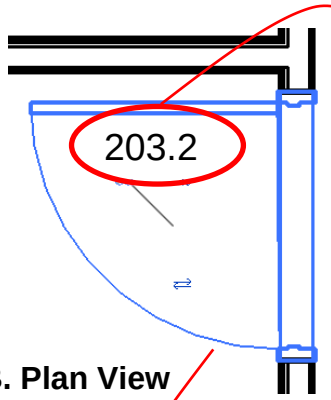
ROOM NUMBER	ROOM NAME	BASE	COUNTER	TRANSACTION COUNTER	VERTICAL
C1					
1A101	WAITING		SSM-15		HPDL-6
1A202	EXAM	RB-3A	SSM-14		HPDL-6
1A207	NURSE STATION	RB-3	SSM-15	SSM-15	HPDL-6,16

12.12 Doors

Door Symbols: Similar to partition types, door types are to be created to accurately reflect each kind of door in regards to type, size and information. The 2-D door symbol is a result of the view that is created from the BIM model. Because of this, 3-D doors shall be used throughout the construction documents for 2-D representations:

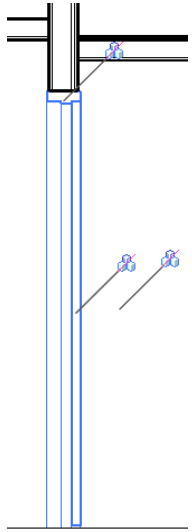


A. Detail View

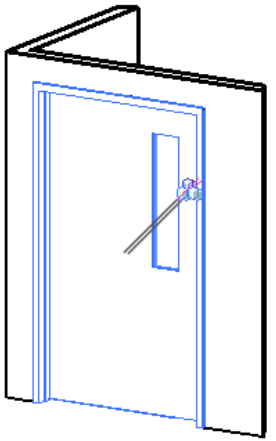


B. Plan View

Door numbers to match the room number in single door instances. Multiple doors require the room number with a ".1", ".2", etc.



C. Section View



D. 3-D View

Door Schedule:

All doors are to be communicated in construction documents by schedule.

DOOR SCHEDULE (B1-B2)

DOOR NO	DOOR						FRAME		LABEL	HDWR	DETAILS (N-AE5.704) U.N.O.		REMARKS
		WIDTH	WIDTH (SEC.)	HEIGHT	MATERIAL	TYPE	MATERIAL	TYPE			HEAD/SILL	JAMB	
201	Pr	7' - 0"		7' - 0"	AL	FG	AL	S29		1.03			R1
202	Pr	7' - 0"		7' - 0"	AL	FG	AL	S29		1.04			
203.1		4' - 0"		7' - 0"	WD	F	HM	1		9.01	1	7,13	
203.2		4' - 0"		7' - 0"	WD	F	HM	1		9.01	1	7,13	
204.1		4' - 0"		7' - 0"	WD	F	HM	8		3.01	1	7,13	R5
204.2		4' - 0"		7' - 0"	WD	F	HM	4		3.00	1	7,13	
204.3		4' - 0"		7' - 0"	WD	F	HM	4		3.00	1	7,13	
204.4		4' - 0"		7' - 0"	WD	F	HM	1		3.00	1	7,13	
205		4' - 0"		7' - 0"	WD	F	HM	1		5.01	1	7,13	
206		4' - 0"		7' - 0"	WD	F	HM	1		5.01	1	7,13	
207		4' - 0"		7' - 0"	WD	F	HM	4		3.00	1	7,13	R5
208		4' - 0"		7' - 0"	WD	F	HM	4		3.00	1	7,13	R5
209		4' - 0"		7' - 0"	WD	F	HM	1		9			
211		3' - 6"		7' - 0"	WD	F	HM	1		9			
212		4' - 0"		7' - 0"	WD	F	HM	1	45	4			
213		4' - 0"		7' - 0"	WD	F	HM	1		5			
214		4' - 0"		7' - 0"	WD	F	HM	1	45	4			
215	Pr	3' - 6"		7' - 0"	HM	F	HM	1		2			
216	Pr	3' - 6"		7' - 0"	HM	F	HM	1		2			

REMARKS AND ABBREVIATIONS:

R1: CARD ACCESS

R2: OPERABLE GLASS WALL

R3: 180 DEGREE DOOR SWING

R4: CASED OPENING

R5: FOR LOCATION OF WALL REVEALS ADJACENT TO DOORS, SEE ENLARGED PLAN, SHEET N-AE4.101. REFER TO INTERIORS DRAWINGS FOR ADDITIONAL INFORMATION.

R6: DECORATIVE GATE REFER TO N-AE5.504

R7: FOR AREAS C3-C4, DOOR NUMBERS 026, 049, 099, AND 123 REFER TO DOOR HARDWARE SCHEDULE DOOR NUMBERS 026.1, 049.1, 099.1, AND 123.1.

UE: PAIR OF DOORS WITH UNEVEN LEAF

PR: PAIR OF DOORS

Door Schedule Parameters built within doors (see schedule above):

- Door Number
- Door Width
- Door Height
- Door Material
- Type
- Frame Material
- Frame Type
- Fire Rating
- Hardware Code
- Head / Sill and Jamb Detail Numbers
- Remarks - Links to 'Remarks and Abreviations" Legend.

The **VA Object Element Matrix**- "Door" category has a complete list of the appropriate door elements for each stage of the project development.

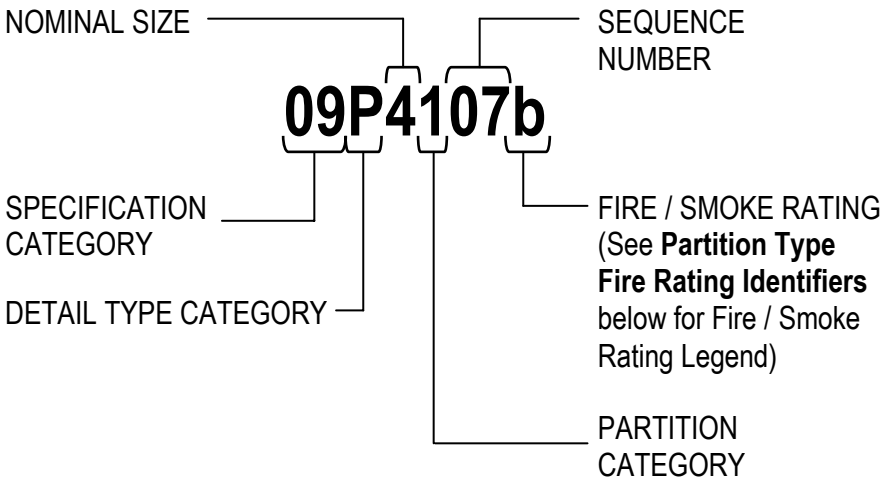
12.13 Interior Partition Types

A different partition type is to be created for each type of wall used in the project with each layer constructed in 3-dimensional form.

Partition Type Classification and Naming:

The following system is an example used to classify, organize and manage partition types within the BIM model. It's used to help project teams establish a naming convention for cataloging all partition types in the BIM model:

PARTITION TYPE CODE EXAMPLE (BIM Model Catalog Number):



PARTITION TYPE CODE LEGEND (Character examples to define other wall types):

SPECIFICATION CATEGORY

03	CONCRETE PARTITION
04	MASONRY PARTITION
09	METAL STUD PARTITION

DETAIL TYPE CATEGORY

P	PARTITIONS

NOMINAL SIZE

1	SIZE 1" CORE
2	SIZE 2" CORE
4	SIZE 4" CORE
6	SIZE 6" CORE
8	SIZE 8" CORE

PARTITION CATEGORY

1	PARTITIONS W/ NO INSULATION
2	PARTITIONS W/ INSULATION
3	PARTITIONS W/ TILE
4	PARTITIONS W/ LEAD LINING
5	PARTITIONS W/ SECURITY MESH

Interior Partition Type Parameters

The "Wall - Interior Partition" in the **VA Object Element Matrix** defines the elements appropriate for each stage of the project development and shall be included as required.

Partition information shall have the ability to be scheduled.

Example of Information built within a partition type:

Parameter	Value
Identity Data	
Keynote	
Model	
Manufacturer	
Type Comments	
URL	http://www.gp.com/build/page
Description	3 5/8" Metal Stud, 5/8" Gypsum
Assembly Description	Partitions - Drywall w/ Metal Stud
Assembly Code	C1010145
Type Mark	19b
Fire Rating	1HR
Cost	
Partition Type Code	09P4107b
Fire Test #	U465
Sound Test #	RAL TL99-103
UL URL	
USG Fire Test URL	
STC	45-49
Specification	

Wall Schedule

Each partition type holds parameters containing descriptions of its components and its construction which is shown in the schedule:

Partition Type Code: A code to catalog partition types in BIM model. **
(Stays constant for all BIM projects)
Type Mark: Construction Document Partition Type Number *
(Different for each project- See **Partition Type Number** below)
Assembly Code: Defines wall at an Industry Level *
Description: Description of wall in model **

* Define for Contract Documents use.
** Model management information (Not provided for specific contract document use)

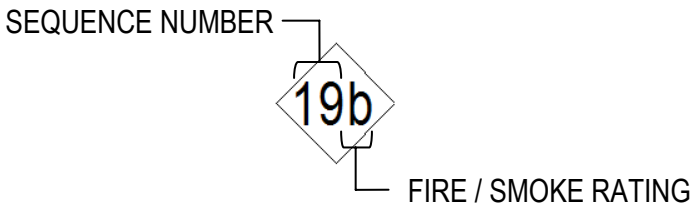
PARTITION SCHEDULE

Type Mark	Partition Type Code	Description	Area	Length
16	09P4101	3 5/8" Metal Stud, 5/8" Gypsum Board on 2 Sides 6" above Ceiling	15730 SF	1792' - 8 1/4"
17	09P4103	3 5/8" Metal Stud, 5/8" Gypsum Board on 1 Side 6" above Ceiling	41227 SF	8645' - 4 3/4"
18	09P4105	3 5/8" Metal Stud, 5/8" Gypsum Board on 1 Side at Full Height	3420 SF	291' - 11 5/8"
19	09P4107	3 5/8" Metal Stud, 5/8" Gypsum Board on 2 Sides at Full Height	226 SF	19' - 10 7/8"
19b	09P4107b	3 5/8" Metal Stud, 5/8" Gypsum Board, Fire Resistant, on 2 Sides at Full Height	10666 SF	1063' - 5 5/8"
19bs	09P4107bs	3 5/8" Metal Stud, 5/8" Gypsum Board on 2 Sides at Full Height	1283 SF	182' - 6 1/4"
20c	09P4109c	3 5/8" Metal Stud, 2 layer of 5/8" Gypsum Board on 2 Sides at Full Height	1391 SF	82' - 7"
21	09P4111	3 5/8" Metal Stud, 5/8" Gypsum Board on both sides- half height	2957 SF	321' - 4 1/8"
21bs	09P4111bs	3 5/8" Metal Stud, 5/8" Gypsum Board on 1 Side at Full Height	472 SF	66' - 0 1/4"
26	09P4201	3 5/8" Metal Stud, Batt Insulation, 5/8" Gypsum Board on 1 Side at Full Height	9372 SF	778' - 4 5/8"
			86743 SF	13244' - 3 1/4"

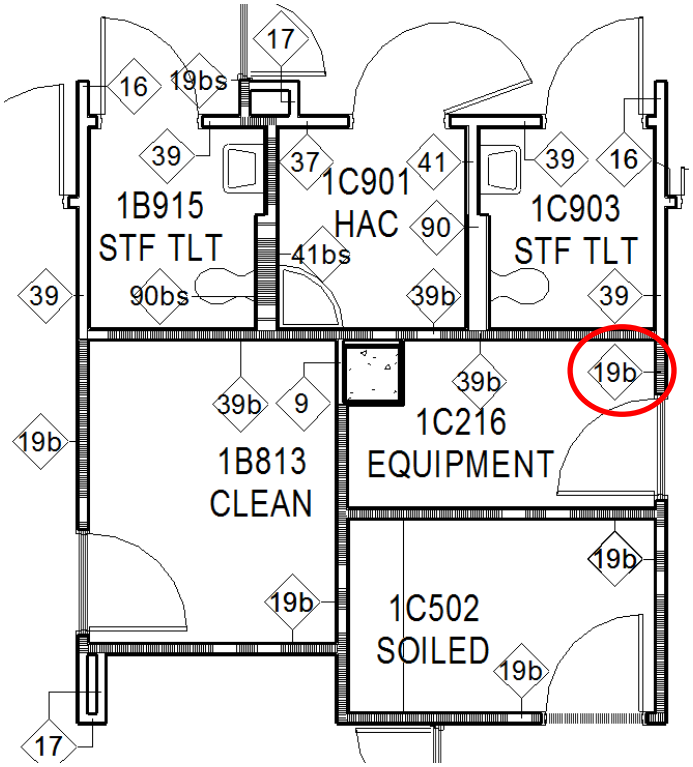
Interior Partition Type Number

The "Type Mark" from the schedule above relates to the construction document partition type number. It is a project specific number allowing appropriate construction document partition type number sequencing. This number which is held in the 3D partition gets tagged in plan and relates to the partition type details:

TYPE MARK



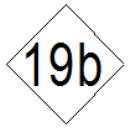
Interior Partition Type tagged in plan:



Interior Partition Type Fire Rating Legend:

No Rating

Smoke Rated



1 Hour Fire Rated

1 Hour Fire & Smoke Rated

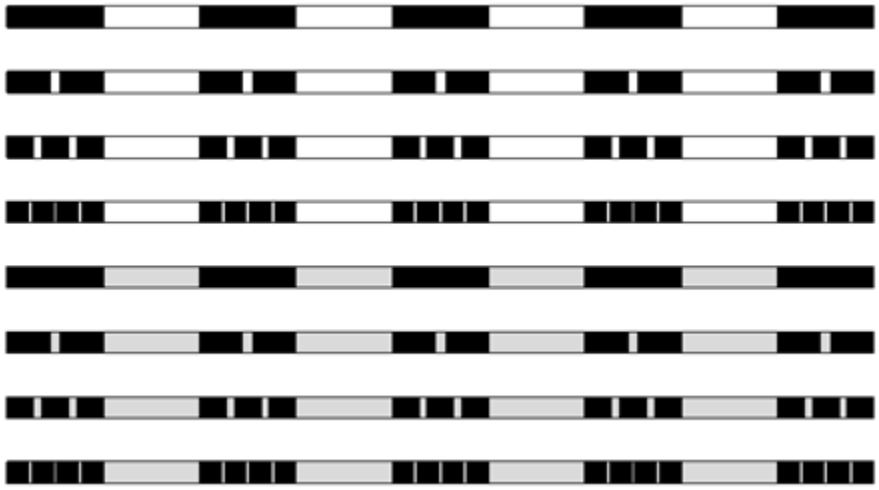
2 Hour Fire Rated

2 Hour Fire & Smoke Rated

Continue the progression of letters in the format above for ratings above 2 Hours.

Fire-Rated Partitions

Fire rating fill patterns are to be constructed within a 3-D wall type so that the partition's respective rating is shown through all scales and through all types of views. The fill patterns shall be graphically represented as follows:



FIRE RESISTIVE RATED WALLS, 1 HOUR

FIRE RESISTIVE RATED WALLS, 2 HOUR

FIRE RESISTIVE RATED WALLS, 3 HOUR

FIRE RESISTIVE RATED WALLS, 4 HOUR

FIRE RATED, SMOKE BARRIER WALLS, 1 HOUR

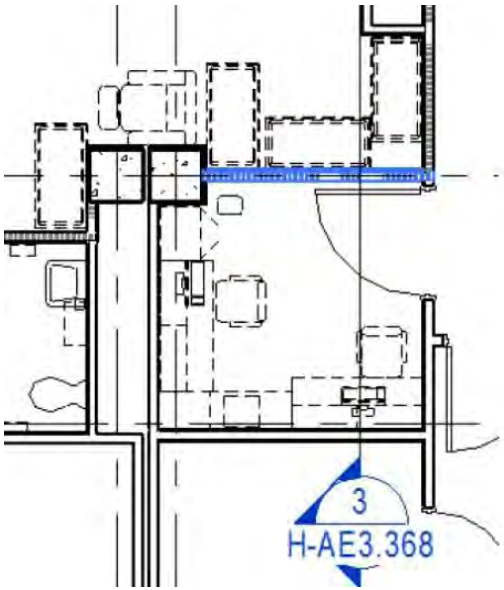
FIRE RATED, SMOKE BARRIER WALLS, 2 HOUR

FIRE RATED, SMOKE BARRIER WALLS, 3 HOUR

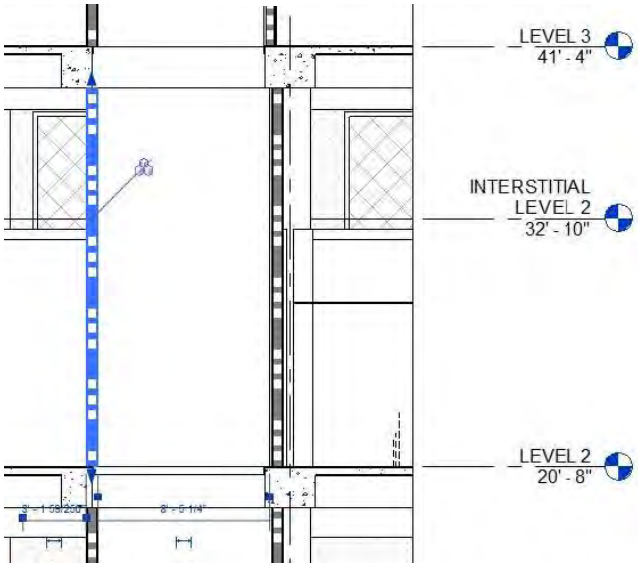
FIRE RATED, SMOKE BARRIER WALLS, 4 HOUR

Examples of patterns showing through a variety of view-types:

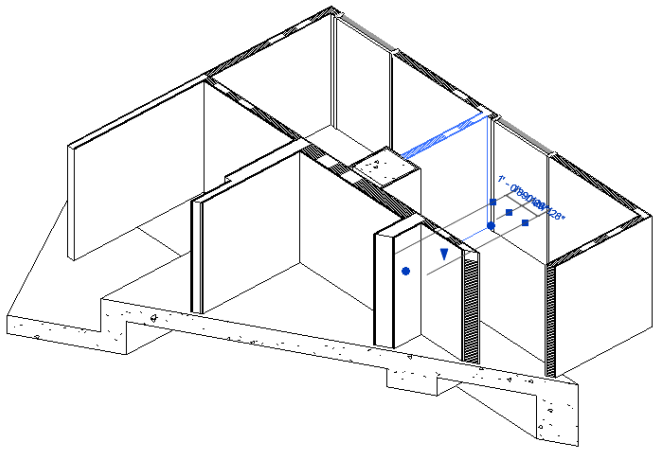
A. Plan



B. Section



C. 3-D



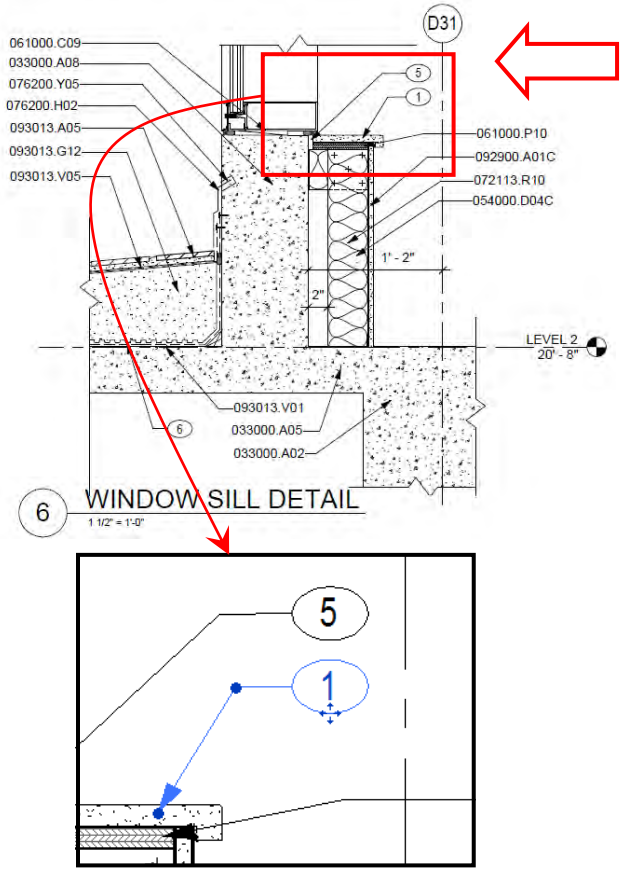
12.14 Model Integrated Text

BIM General Notations:

Any notation that will populate multiple sheets shall be put on views that allow duplication of the notations on multiple sheets. See image to right for an example.

BIM Sheet Notes:

Element-based schedules shall be used for notation that is specific per sheet.



NOTES:

SHEET NOTES:

A. REFER TO SHEET G-011 FOR GENERAL ABBREVIATIONS AND ARCHITECTURAL SYMBOLS.

B. EXTEND GYPSUM BOARD TO BOTTOM OF CEILING PLATFORM IN AREAS WHERE NO CEILING IS SCHEDULED.

C. REFER TO FINISH SCHEDULE SHEETS H-IN6 SERIES FOR FINISH INFORMATION.

D. SEE SHEETS H-LS1.0FA THRU H-LS1.5FE FOR LIFE SAFETY PLANS.

Notation Object's Parameters:

Sheet Number	H-AE5.170
Number	1
Description	SOLID SURFACE STOOL ON PLYWOOD SUBSTRATE

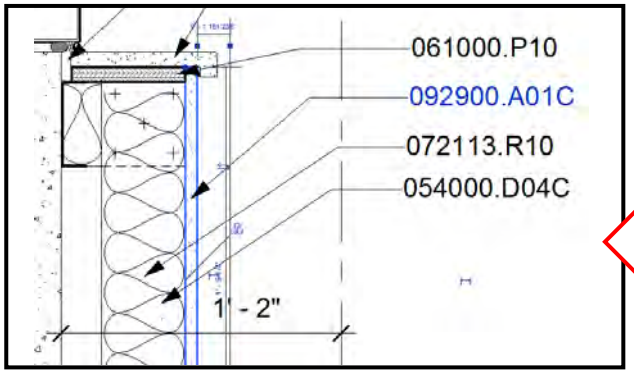
00 KEYNOTES

1 SOLID SURFACE STOOL ON PLYWOOD SUBSTRATE
2 REFER TO REFLECTED CEILING PLANS FOR CEILING HEIGHTS
3 DRAPERY POCKET
4 PARTITION TYPE 77c
5 HOLD BACK OF STOOL & PLYWOOD 1/2" FROM CONCRETE CURB AND LOOSE PACK w/INSULATION
6 DRAINAGE MAT

BIM Material Notation:

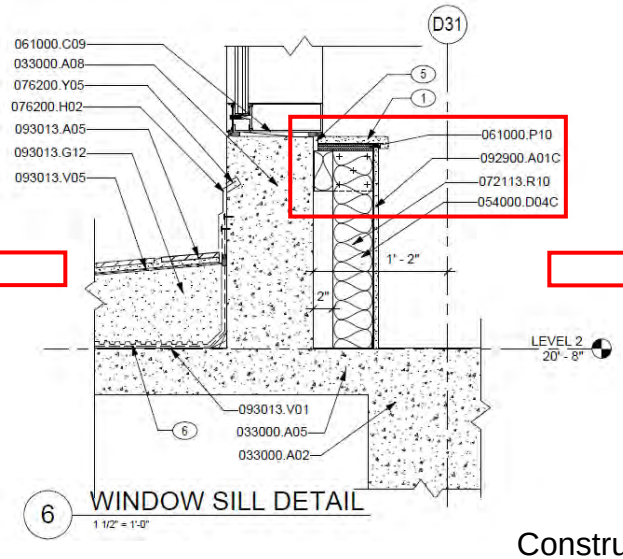
Rather than using loose text, BIM software allows model objects to be linked from the object's parameters to an editable text file that holds specification data for Construction Document notation purpose. This notation has the ability to be shown by either numeric specification section or object description:

Specification Section:

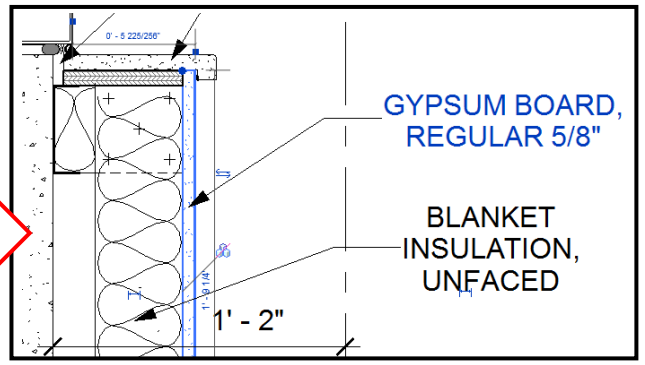


092900.A01C

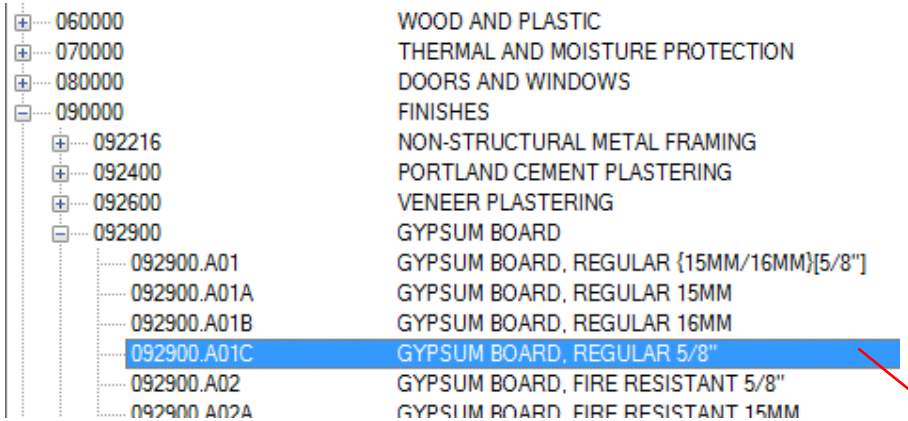
Specification Section Catalog Sorting Digits



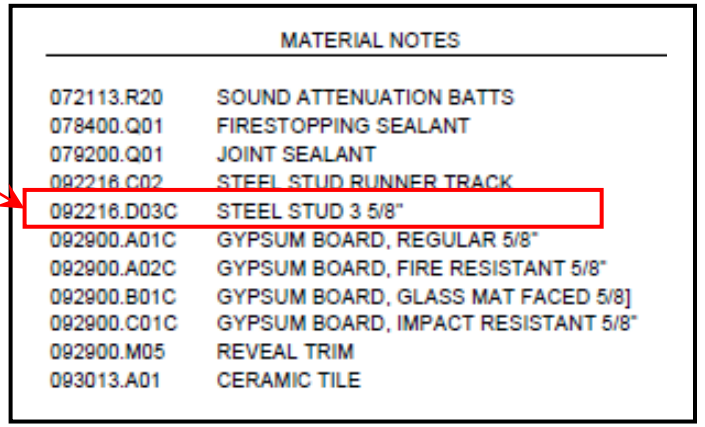
Object Description:



Editable Text File:

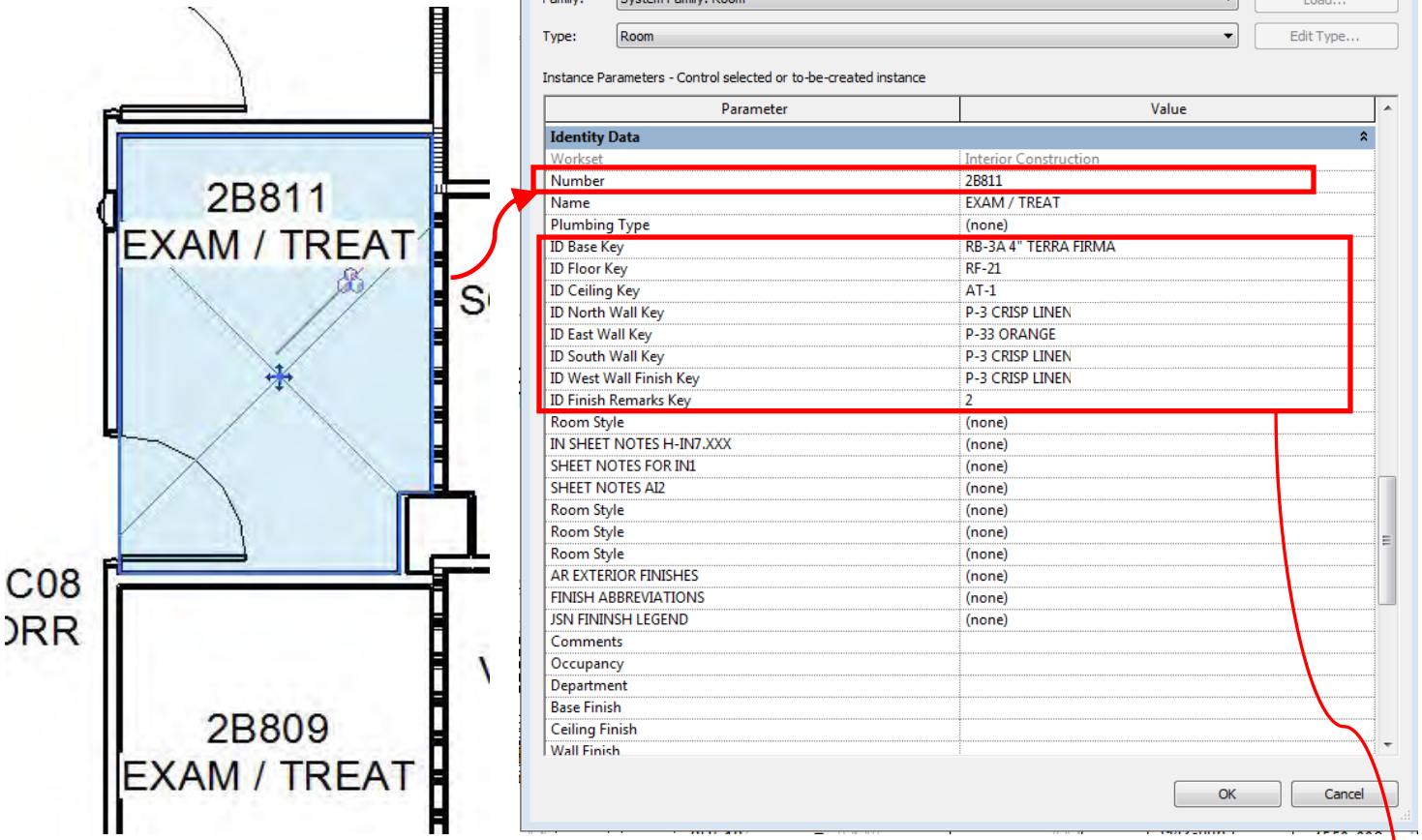


Construction Document Notation:



12.15 Room Finishes

Room Finishes shall be assigned to the room areas through the room properties, with Parameters defining finish assignments. Finishes assigned to the room properties shall be formatted into a Room Finish Schedule to be placed on a sheet.



FINISH SCHEDULE SHEET H-IN6.204

ROOM NUMBER	ROOM NAME	FLOOR	BASE	WALLS				CEILING	ID FINISH REMARKS
				NORTH	EAST	SOUTH	WEST		
2B807	EXAM / TREAT	RF-21	RB-3A	P-3	P-3	P-3	P-34	AT-1	2
2B809	EXAM / TREAT	RF-21	RB-3A	P-3	P-35	P-3	P-3	AT-1	2
2B811	EXAM / TREAT	RF-21	RB-3A	P-3	P-33	P-3	P-3	AT-1	2

12.16 Finish Legend

Material Codes in the Room Finish Schedule that were entered in the room properties are identified in a Finish Legend. Product information is entered into the established parameters to specify finishes. Finish codes and their description shall be associated with the room properties.

FINISH SCHEDULE SHEET H-IN6.204

ROOM NUMBER	ROOM NAME	FLOOR	BASE	WALLS NORTH	WALLS EAST	WALLS SOUTH	WALLS WEST	CEILING	ID FINISH REMARKS
2B807	EXAM / TREAT	RF-21	RB-3A	P-3	P-3	P-3	P-34	AT-1	2
2B809	EXAM / TREAT	RF-21	RB-3A	P-3	P-35	P-3	P-3	AT-1	2
2B811	EXAM / TREAT	RF-21	RB-3A	P-3	P-33	P-3	P-3	AT-1	2

5 6 7 8

WALL FINISH LEGEND

FINISH CODE	MATERIAL	MANUFACTURER	MANUFACTURER NO.	PATTERN	COLOR	SIZE	GROUT	ID FINISH REMARKS
AWP-6	ACOUSTICAL WALL PANEL	SONEX	UNX-3	CLASSIC URETHANE	CHARCOAL	3"		
AWP-10	ACOUSTICAL WALL PANEL	NOVAWALL		FABRIC COVERED PANEL WITH 3LB DENSITY CORE	MAHARAM FABRIC, GLIMMER 901876-001			
CT-1	CERAMIC TILE	DALTILE		KEYSTONE MOSAICS	ARCHITECTURAL GRAY D109	3" x 3"	GROUT-1	
EC-1	EPOXY COATING	SHERWIN WILLIAMS	SW 6378		CRISP LINEN			
EC-9	EPOXY COATING	SHERWIN WILLIAMS	SW 6113	PRO INDUSTRIAL EPOXY	INTERACTIVE CREAM			
GLT-4	GLASS TILE	OCEANSIDE GLASSTILE		TESSERA IRIDESCENT	SANDSTONE 005	1" x 1"		
GROUT-1	GROUT	QUARTZ LOCK	165	ANTIQUE WHITE	EPOXY			
MWP-1	METAL WALL PANEL	PPG	UC45074	DURANAR	LIGHT SEA WOLF			
P-3	PAINT	SHERWIN WILLIAMS	SW 6378	SEMI GLOSS	CRISP LINEN			
P-12	PAINT	SHERWIN WILLIAMS	SW 6113	SEMI GLOSS	INTERACTIVE CREAM			
P-16	PAINT	SHERWIN WILLIAMS	SW 6432	SEMI GLOSS	GARDEN SPOT			
P-18	PAINT	BENJAMIN MOORE	2063-20	SEMI GLOSS	DOWN POUR BLUE			
P-20	PAINT	SHERWIN WILLIAMS	SW 0009	SEMI GLOSS	EASTLAKE GOLD			
P-22	PAINT	SHERWIN WILLIAMS	SW 6356	SEMI GLOSS	COPPER MOUNTAIN			
P-26	PAINT	SHERWIN WILLIAMS	SW 6368	SEMI GLOSS	BAKELITE GOLD			
P-29	PAINT	SHERWIN WILLIAMS	SW 7018	SEMI GLOSS	DOVETAIL			
P-33	PAINT	BENJAMIN MOORE	2157-30	SEMI GLOSS	BUTTERSCOTCH			
P-34	PAINT	BENJAMIN MOORE	538	SEMI GLOSS	VIENNA GREEN			
P-35	PAINT	BENJAMIN MOORE	767	SEMI GLOSS	GRACEFUL SEA			
P-36	PAINT	BENJAMIN MOORE	HC-12	SEMI GLOSS	CONCORD IVORY			
PPT-19	PORCELAIN TILE	IRIS US		BRUSHSTROKES	BEIGE	12" x 24"	GROUT-1	
PPT-20	PORCELAIN TILE	IRIS US		BRUSHSTROKES BULLNOSE	OYSTER	6" x 24"	GROUT-1	
PPT-20A	PORCELAIN TILE	IRIS US		BRUSHSTROKES	OYSTER	6" x 24"	GROUT-1	
PPT-20B	PORCELAIN TILE	IRIS US		BRUSHSTROKES	OYSTER	12" x 24"	GROUT-1	
STN-3	STONE	ARCHITECTURAL STONE DESIGN		TRAVERTINE SLAB, POLISHED	MANGO	3/4"		
VP-7	VENEER PLASTER	SOUTHWEST PROGRESSIVE ENTERPRISES		SPE THERMOCHROMEX	CUSTOM 1103.31 8/31/09			
VP-8	VENEER PLASTER	SOUTHWEST PROGRESSIVE ENTERPRISES		SPE THERMOCHROMEX	TBD			
WAP-1	WOOD ACOUSTICAL PANEL	RULON	900 SERIES	ALURATONE CHERRY VENEER, QUARTER CUT	STAINED TO MATCH ARMSTRONG NATURAL VARIATIONS WOOD CEILING, NDC DARK CHERRY			CUSTON 2" CLEAR EDGE
WDV-5	WOOD VENEER			ITALIAN POPLAR	STAINED TO MATCH ARMSTRONG NATURAL VARIATIONS WOOD CEILING, NDC DARK CHERRY			
WP-20	WALL PANEL	MODULAR ARTS		SWIM	PAINT TO MATCH P-3			

Instance Properties

Family: System Family: Room — Load...

Type: Room — Edit Type...

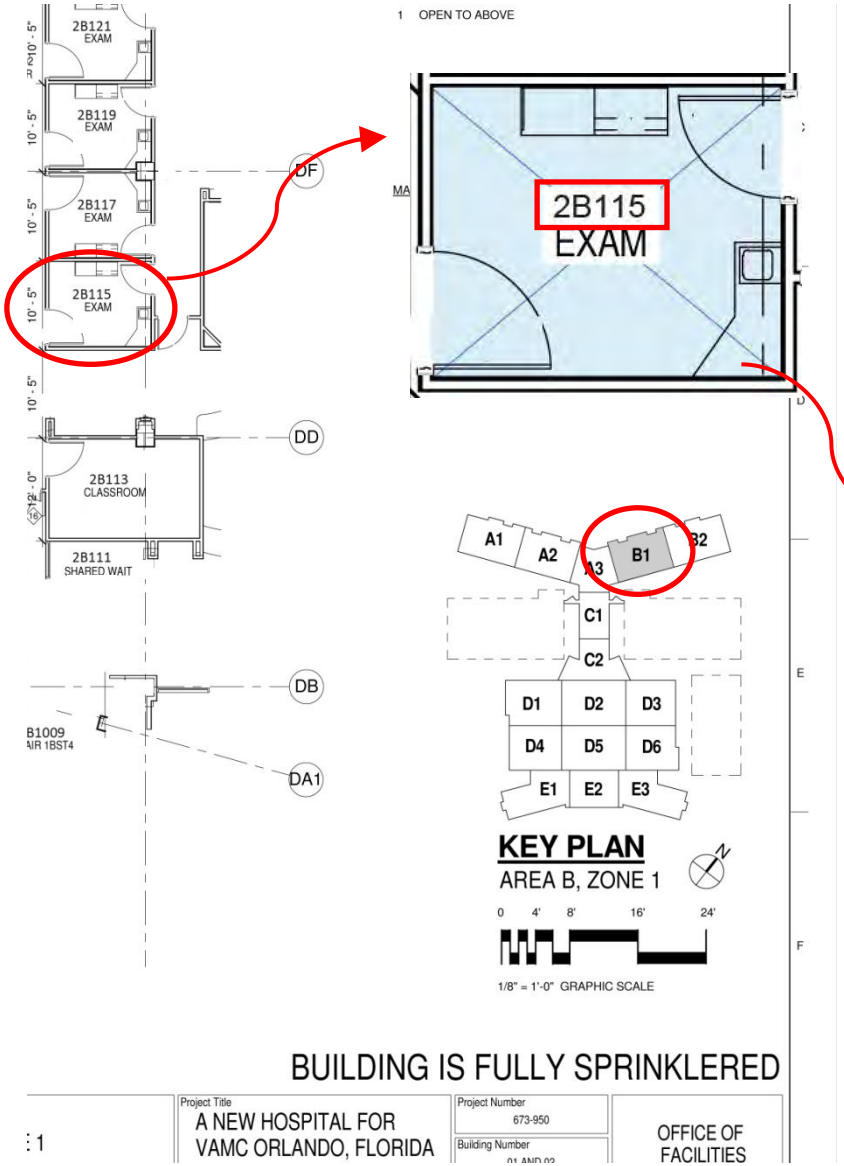
Instance Parameters - Control selected or to-be-created instance

Parameter	Value
Base Color Key	TERRA FIRMA
Base Size Key	4"
Base Finish Remarks Key	
Floor Finish Code Key	RF-21
Floor Material Key	RESILIENT FLOORING
Floor Manufacturer Key	CENTIVA
Floor Manufacturer No. Key	UP1126
Floor Pattern Key	EVENT ULTRAPLANK
Floor Color Key	RED ELM
Floor Size Key	4" x 36"
Floor Grout Key	
Floor Finish Remarks Key	
Ceiling Finish Code Key	AT-1
Ceiling Material Key	ACOUSTICAL CEILING TILE
Ceiling Manufacturer Key	ARMSTRONG
Ceiling Manufacturer No. Key	589
Ceiling Pattern Key	CIRRUS
Ceiling Color Key	WHITE
Ceiling Size Key	24" x 24" x 3/4"
Ceiling Grid Key	SUPRAFINE 9/16" EXPOSED TEE GRID, WHITE
Ceiling Finish Remarks	
N - Wall Finish Code Key	P-3
N - Wall Material Key	PAINT
N - Wall Manufacturer Key	SHERWIN WILLIAMS
N - Wall Manufacturer No. Key	SW 6378
N - Wall Pattern Key	SEMI GLOSS
N - Wall Color Key	CRISP LINEN
N - Wall Size Key	
N - Wall Grout Key	

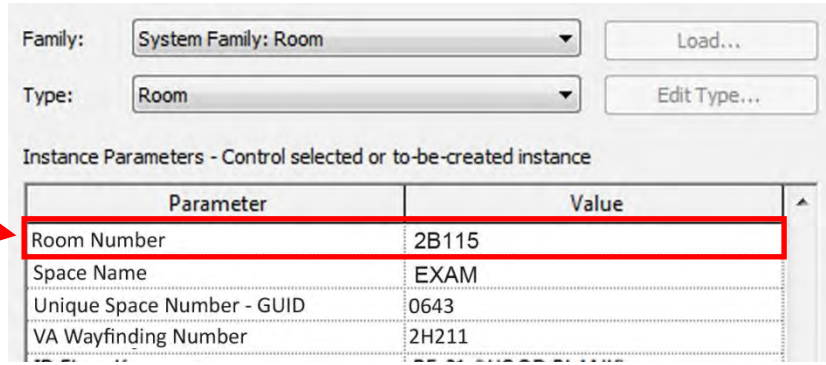
OK Cancel

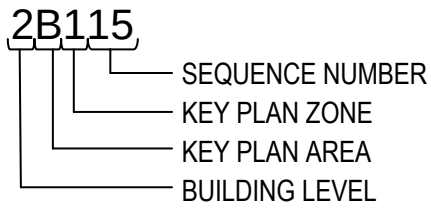
12.17 Room Numbering

Room numbers shall be assigned to the properties of each individual room. (See Space Naming and Coding in this document.) Room tag types can be modified throughout the course of the project so that the appropriate room number is visible on the (submitted) documents. Refer to the VA Technical Information Library (TIL) for VA Room Numbering Criteria. http://www.cfm.va.gov/til/signs/signage09.pdf



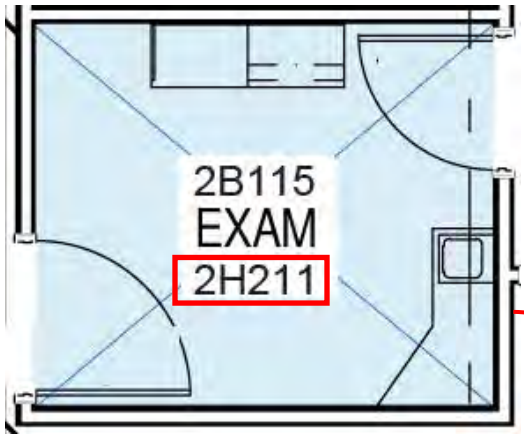
Construction Document Number: The construction document number is manually entered into the room parameters which allows for the Construction Document Room Number to tie into Key Plan zones of the Building. Key Plan zones are defined per 1/8" plans of Building Layout. This provides for a document way-finding that is helpful to reviewers and contractors when using Construction Documentation.





12.18 Wayfinding

The VA Wayfinding Number shall be scheduled data within room schedules such as the Signage/Message Schedule shown below The information shown identifies that the VA Wayfinding Number can shown graphically by plan.



Family: System Family: Room — Load...

Type: Room — Edit Type...

Instance Parameters - Control selected or to-be-created instance

Parameter	Value
Room Number	2B115
Space Name	EXAM
Unique Space Number - GUID	0643
VA Wayfinding Number	2H211

SIGNAGE/MESSAGE SCHEDULE

Construction Document Number	Space Name	Sign Type	VA Wayfinding Number	Message Name
2B1015	EXAM		2H211	EXAM
2B1016	EXAM		2H210	EXAM
2B1017	EXAM		2H213	EXAM
2B1018	EXAM		2H212	EXAM
2B1019	EXAM		2H215	EXAM

13. Glossary

Terms:

AE, AEC, AECFM

Abbreviations for Architect/Engineer, Architect/Engineer/Contractor, Architect/Engineer/Contractor/Facility Manager

Building Information

- **Building Information Model – Product**

An object-based digital representation of the physical and functional characteristics of a facility. The Building Information Model serves as a shared knowledge resource for information about a facility, forming a reliable basis for decisions during its lifecycle from inception onward.[22]

- **Building Information Modeling – Process**

A collection of defined model uses, workflows, and modeling methods used to achieve specific, repeatable, and reliable information results from the model. Modeling methods affect the quality of the information generated from the model. When and why a model is used and shared impacts the effective and efficient use of BIM for desired project outcomes and decision support.

- **Building Information Management – Data Definition**

Building Information Management supports the data standards and data requirements for BIM use. Data continuity allows for the reliable exchange of information in a context where both sender and receiver understand the information.[23]

CAD

Computer Aided Design. A geometric/symbol based computer drawing system that replicated hand drawing techniques.

COBIE

The model and facility data for the commission, operations, and maintenance of the project shall satisfy the Construction Operations Building Information Exchange (COBIE) requirements, and be submitted in compliance with the commissioning requirements. The data expected from BIM for facility handover shall conform to the following standards: VA-SEPS, Uniformat, OmniClass, Geospatial, NBIMS, COBIE, NCS, and IFC standards for building information. COBIE data in the form of the COBIE Excel Spreadsheet and related commissioning information shall be delivered electronically in formats suitable for integration into current and future CAFM systems.

General Services Administration Guidelines

Guidelines used by the General Services Administration: *GSA Building Information Modeling Guide Series: 02 – GSA BIM Guide for Spatial Program Validation, v 0.96,* (April 2007) are some of the first developed for use in Federal buildings and can offer valuable insight into Building Information Modeling. They can be found on the GSA's web site.

Interoperability

The Institute of Electrical and Electronics Engineers defines interoperability[24] as "the ability of two or more systems or components to exchange information and to use the information that has been exchanged." James A. O'Brien and George M. Marakas, authors of *Management Information*

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[22] *National BIM Standards* BIM product definition
[23] Semantic Interoperability
[24] Institute of Electrical and Electronics Engineers. IEEE Standard Computer Dictionary: A Compilation of IEEE Standard Computer Glossaries. New York, NY: 1990.

Systems, further define interoperability as ”being able to accomplish end-user applications using different types of computer systems, operating systems, and application software, interconnected by different types of local and wide area networks.” Semantic interoperability refers to the ability to interpret the information exchanged automatically to produce results that are deemed useful by the end users of both systems.

Industry Foundation Class

Industry Foundation Class (IFC) is a system of defining and representing standard architectural and construction-related graphic and non-graphic data as 3D virtual objects[25] to allow data exchange among BIM tools, cost estimation systems, and other construction-related applications in a way that preserves ability to perform analysis on those objects as they move from one BIM system to another,

VA accepts the latest IFC format. For VA projects, a design professional either saves or exports an IFC file from the BIM-authoring software of their choice for the following tasks:[26]

- Coordination of BIM models and related design disciplines.
- Clash detection
- Rules-based checking
- Building Code compliance
- Sharing models between different BIM-authoring softwares
- COBIE data derived from BIM models
- Energy testing data derived from BIM models
- Systems simulation

OmniClass

The OmniClass Construction Classification System is a classification system for the construction industry, developed by the Construction Standards Institute (CSI) and is used as a classification structure for electronic databases. As the basis of its tables, OmniClass incorporates other existing systems currently in use, including MasterFormat™ for work results, UniFormat for elements, and EPIC (Electronic Product Information Cooperation) for structuring products.

VA-**SEPS**

The Space and Equipment Planning System (VA-SEPS) is a database shared by the Army, Navy, Air Force, and VA as a tool, based on medical need, to determine the space and medical equipment necessary to support the requirements for space.

Space Calculations

VA-SEPS calculates net square feet (NSF) for a department’s constituent spaces. Then VA-SEPS aggregates these areas to Departmental Net Square Feet.[27] The VA-SEPS user may modify the net square feet for a functional space as professional judgment requires. Based on space type,[28] rules apply a Departmental Net to Departmental Gross (DNTDG) factor to yield a Departmental Gross Square Foot (DGSF) area. [29]

That DGSF area is then multiplied by a “building conversion factor,” yielding a Building Gross Square Foot (BGSF) figure for that department. The BGSF figure represents how much of the gross building area is contributed by the particular department. The standard baseline Building Net-to-Gross factor used by VA-SEPS and VA is 1.35.

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[25] IFC also sometimes refers to its non-proprietary file extension, “IFC.”
[26] As of May 2009, IFC2x4 has its feature set frozen and is concluding the beta-1 test phase.
[27] See also http://www.cfm.va.gov/TIL/space/dgconv-factors2-07.xls for use of the term “Programmed Departmental Net Square.”Feet
[28] …also designated as “DNTG” in various places. *See also* http://www.cfm.va.gov/TIL/space/dgconv-factors2-07.xls for the chapters in design guides describing departments and associated DNTDG factors. There are about 60 functional space types using 12 different factors.
[29] http://www.cfm.va.gov/til/VA-SEPSNTG.asp

This is known as the "two-step method," and is the one currently in use for VA *VA-SEPS*. The two-step method allows varying the building conversion factor to suit a department's distinctive net-to-gross factor, while the Building Net-to-Gross *Ratios* (shown below) take into account the distinctive net-to-gross factors resulting from facility type.

The sum of all the BGSF areas for the various departments constituting the proposed design will sum to the gross area of the building.

- **Net square feet (NSF)** is the floor area between the walls of a room or defined space.
- **Department Net Square Feet (DNSF)** is the sum of the net square feet of all of the individual rooms and spaces within a department.
- **Building Net Square Feet (BNSF)** is the sum of all of the Department Net Square Feet within a building/facility.
- **Department Gross Square Feet (DGSF)** is the floor area within the boundaries of a functional department as defined by a space planning criteria chapter, including floor area occupied by rooms/spaces, walls defining the spaces, and circulation corridors connecting the different rooms of the department.
- **Building Gross Square Feet (BGSF)** is the floor area of the entire building or project, which includes floor area occupied by rooms/spaces, walls, corridors, conveyances, mechanical/utility rooms, and shafts."

Accordingly,[30] "users adjust this factor [1.35] so as not to exceed the following Building Net-to-Gross Ratios:"

VA Outpatient Clinic / Outpatient Clinic Additions	90% (1.90 x NSF)
VA Medical Center	100% (2.0 x NSF)
VA Clinical / Clinical Support Addition (Any chapter not indicated below)	90% (1.90 x NSF)
VA Community Living Center (Nursing Home)	70% (1.70 x NSF)
VA Mental Health Residential Rehabilitation Treatment Program (Domiciliary)	60% (1.60 x NSF)
VA Mental Health Hospital	85% (1.85 x NSF)

Figure 3 - Building Net-to-Gross Ratio Limits

The project is constrained by the Net-to-Gross Ratios for the design's total building gross area. The building Net-to-Gross Ratios are downward constraints on VA-SEPS' bottom-up progressive aggregation

The PFD resulting from VA-SEPS may thus be a list of named spaces, each with a NSF figure, an intermediate department-by-department DGSF area, a BGSF area, and a budgetary cost.

[30] See http://www.cfm.va.gov/TIL/space/buildnet-grossfactors.doc. These are really gross-to-net ratios, since the ratio values are greater than or equal to 1. See also http://www.cfm.va.gov/til/VA-SEPSNTG.asp

All required functional areas and associated support spaces shall fit within this resulting space, determining and specifying their adjacencies and construction costs. Some adjacency descriptions may occur in comments and notes belonging to equipment and/or to certain functional areas and may be provided as part of the VA-SEPS export.

Net square feet (NSF) as defined above, shall be the defining kernel of space-counting procedures for the VA and must be adapted for use in BIM modeling that is based directly on the PFD coming out of VA-SEPS. [31]

Space Measurement

VA adopts a fundamental method of measuring area that synchronizes in a practical way with major BIM authoring tools. ***TIP:*** *When representing double wall in the BIM, build the wall components or layers into a single wall object. This allows for quantity take off by material, or by system, and simplifies the overall building of the model.*

Area The area bounded by the inside faces of surrounding walls, minus the area bounded by the outside faces of contained full height columns will be the net area of a space.'[32]

BIM authoring tools allow areas to be automatically delineated based on the footprint of surrounding walls which create a polygon, or based on a manually drawn polygon. The areas of contained columns can be automatically subtracted in a flexible, size-dependent way, to yield a net area meeting the VA's definition.

Manual methods for delineating areas are required to allow centerlines of adjacent spaces to be used while allowing the corridor face to bound the space on the corridor side.

Volume: Space volume is determined manually and geometrically by specifying an area footprint and assigning a height to it. Volume calculations in BIM do not change any existing volume guidelines found in VA documentation.[33]

Volumetric calculations may require some adjustments in how the BIM is constructed and how space is delineated, in particular with regard to multistory spaces, and cavity walls. As with BIM tools that create and place building elements, BIM "space objects" must be used in the way prescribed by the BIM authoring software if volumes are to be correct, if equipment location reports are to be correct, and if the exported IFC model for analysis is to yield correct results. For example, the count of occupied space volume under sloped building elements is typically adjusted to accommodate concepts of usable space. On the other hand, equipment can occupy the space otherwise not counted as usable. The Design Team may find that for correct reporting purposes, different categories of space enclosing nearly the same volumes will have to be defined in the BIM and reported out judiciously. [34]

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[31] The VA definition of *Net square feet (NSF)* appears to be the same as *GSA BIM Area.*

[32] GSA calls this "GSA BIM Area" which was formerly called "GSA Net Area." (*GSA BIM Guide Series 02*, v 0.96 (May 2006).

[33] For example, see Appendix 1-A, VA Hospital Building System, *HVAC Design Manual for New Hospitals, Replacement Hospitals, …,* (February 2008), for the description of Hospital Building System modules and the designations which BIMs must carry if VAHBS is used.

[34] For informational purposes only, A/Es new to BIM may find "Section 04," subsections 4.1.1ff in *GSA BIM Guide Series 02*, v 0.96 (May 2006) to provide a helpful discussion of what the basic space modeling issues may be, and some insight regarding the various BIM-authoring tools and how they might handle the situations described. Readers are advised that some BIM software *may* have changed in ways which render the publication somewhat dated.

14. Credits

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